

December 5, 2000

Mr. Michael A. Balduzzi
Vice President, Operations
Vermont Yankee Nuclear Power Corporation
185 Old Ferry Road
P.O. Box 7002
Brattleboro, VT 05302-7002

SUBJECT: SAFETY EVALUATION OF THE REQUEST FOR RELIEF FROM THE AMERICAN
SOCIETY OF MECHANICAL ENGINEERS (ASME) BOILER AND PRESSURE
VESSEL CODE, VERMONT YANKEE NUCLEAR POWER STATION (TAC NO.
MA9116)

Dear Mr. Balduzzi:

By letter dated June 1, 2000, and supplements dated August 11, August 24, and October 11, 2000, you requested relief from the ASME Boiler and Pressure Vessel Code (the Code), Section XI requirements regarding a leak in a pressure retaining component at Vermont Yankee Nuclear Power Station. The leak was detected in the reactor building recirculation unit No. 8 (RRU-8) inlet stub connection for the cooling coil. The flaw causing the leak was characterized as a pin hole less than 1/16 inch in diameter. Since initial detection, you have informed us that the leakage has stopped. The leak was attributed to partial fusion of a portion of the brazed joint that occurred during the manufacturing process.

We have concluded that relief may be granted from the Code repair requirements. The staff finds that performing a Code repair on the leaking RRU-8 inlet stub connection while the Unit is operating is impractical. The staff concludes that the granting of relief where Code requirements are impractical and imposing alternative requirements is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration to the burden upon the licensee and facility that could result if the Code requirements were imposed on the facility. Pursuant to 10 CFR 50.55a(g)(6)(i) and consistent with the guidance in GL 90-05, relief is granted through the next refueling outage scheduled to start in 2001.

Our detailed evaluation and conclusions are documented in the enclosed safety evaluation.

Sincerely,

/RA by Victor Nerses for/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-271

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF FROM ASME CODE REPAIR REQUIREMENTS

FOR REACTOR BUILDING RECIRCULATION UNIT

INLET STUB CONNECTION FOR THE COOLING COIL

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

1.0 INTRODUCTION

By letter dated June 1, 2000, and supplemented by letters dated August 11, August 24, and October 11, 2000, Vermont Yankee Nuclear Power Corporation (the licensee) requested relief from the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (the ASME Code), Section XI requirements regarding repair to a leak in a pressure retaining component at Vermont Yankee Nuclear Power Station. The leak was detected in the reactor building re-circulation unit No. 8 (RRU-8) inlet stub connection for the cooling coil. The inlet stub connection material is copper, and the joint where the leakage was detected is a brazed butt joint, which has an outer diameter of 2.625 inches and a nominal wall thickness of 0.065 inch. The RRU-8 inlet stub connection has a design temperature of 32 to 150 °F and pressure of 125 psig.

The flaw was characterized as a pin hole less than 1/16 inch in diameter. The leakage at the time of discovery was approximately 0.005 gpm, which is a small fraction of the design coil flow rate of 146 gpm. Since then the leakage has stopped. The licensee attributed the leak or root cause to partial fusion of a portion of the brazed joint that occurred during the manufacturing process.

The licensee considered the on-line repair of the RRU-8 inlet stub connection not practical because a Code repair cannot be completed within the time frame for the limiting condition for operation (LCO) without the risk of having to initiate an unnecessary plant shutdown. Based on the above, the licensee submitted a relief request from the ASME Code requirements until a Code repair can be performed during the next refueling outage scheduled for 2001.

2.0 DISCUSSION AND EVALUATION

Generic Letter (GL) 90-05 provides guidance to the staff for evaluating relief requests submitted by licensees for temporary non-Code repairs to Code class 3 piping. The licensee has stated that "GL 90-05 is not applicable to the leakage in the RRU coil unit, as the RRU and the individual tubes are not classified as piping but are considered to be a component." Although the licensee maintained that GL 90-05 is not applicable to the leakage of RRU-8 inlet stub connection, it has addressed all four evaluation elements (acceptance criteria) specified in

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GL 90-05: (1) impracticability determination; (2) root cause determination and flaw characterization; (3) flaw evaluation; and (4) augmented inspection. The staff found GL 90-05 useful for the present application because the RRU-8 inlet stub connection is connected directly to the service water (SW) system, and this stub connection, with its main body shaped like a pipe, may be considered as an extension of the SW system. Consequently, the staff utilized the guidance in GL 90-05 to conduct the review.

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), requires nuclear power facility piping and components to meet the applicable requirements of Section XI of the Code. This section of the Code specifies Code-acceptable repair methods for flaws that exceed Code acceptance limits in piping that is in service. Section XI, IWA-4000 of the Code requires the restoration of the structural integrity of flawed Code piping, independent of the operational mode of the plant when the flaw is detected. Those repairs not in compliance with Section XI of the Code are non-Code repairs.

In some circumstances the required Code repair may be impractical unless the facility is shut down. In such cases, the Commission may evaluate determinations of impracticability and may grant relief and impose alternative requirements pursuant to 10 CFR 50.55a(g)(6)(i). GL 90-05 provides guidance to the staff for evaluating relief requests submitted by licensees for temporary non-Code repairs to Code class 3 piping.

On November 7, 1991, the Commission issued GL 91-18, "Information to Licensees Regarding two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability." This generic letter and the NRC Inspection Manual Part 9900 provided detailed discussions of specific operability determinations, one of which was operational leakage. In this regard, Section 6.15 of Part 9900 states the following:

"Upon discovery of leakage from a Class 1, 2, or 3 component pressure wall (i.e., pipe wall, valve body, pump casing, etc.) the licensee should declare the component inoperable. The only exception is Class 3 moderate energy piping as discussed in Generic Letter 90-05. For Class 3 moderate energy piping, the licensee may treat the system containing the through-wall flaw(s), evaluated and found to meet the acceptance criteria in Generic Letter 90-05, as operable until relief is obtained from the NRC."

The four evaluation elements or acceptance criteria for GL 90-05, as stated above, have been addressed by the licensee. The licensee, also as noted above, has determined an in-line repair is impractical and the root cause was partial fusion of the brazed joint.

The licensee has performed a flaw characterization and evaluation. To demonstrate the structural integrity of the inlet stub connection joint, the licensee has performed structural analyses in accordance with ANSI B31.1 (1977), which is the design Code for this piping. The licensee considered a postulated circumferential flaw of 1 inch for the normal condition and 2 inches for the faulted condition and demonstrated that the joint is within Code allowable stress limits. The licensee's analysis is acceptable for a joint made of ductile material. However, due to the lack of material information for the brazed joint, it is desirable to also conduct an analysis using the more conservative linear elastic fracture mechanics (LEFM) approach. The staff employed the through-wall flaw approach of GL 90-05, which is a methodology based on LEFM,

to conduct an additional evaluation. The staff analysis indicated that the applied stress intensity factor (K) for a postulated 1-inch flaw is $21.43 \text{ ksi(in)}^{1/2}$, which is less than the fracture toughness of $135 \text{ ksi(in)}^{1/2}$ specified for austenitic stainless steel and the fracture toughness of $35 \text{ ksi(in)}^{1/2}$ specified for ferritic steel. Since the brazed joint is very unlikely to be more brittle than ferritic steel, it is adequate to assume that the fracture toughness for the brazed joint is $35 \text{ ksi(in)}^{1/2}$. Considering the 1-inch flaw size assumed for the 1/16-inch hole and the margin between the applied K of $21.43 \text{ ksi(in)}^{1/2}$ and the fracture toughness of $35 \text{ ksi(in)}^{1/2}$, the staff concludes that the brazed joint meets the flaw evaluation requirement of GL 90-05. Hence, the structural integrity of the inlet stub connection is adequate for continued operation of Vermont Yankee until the next refueling outage scheduled to start in 2001. The licensee did not propose to install any temporary device over the hole because the connection is currently not leaking. Further, the issues of flooding, water spraying on other equipment, and loss of flow were analyzed and found to be insignificant to the operation of the SW system.

Since performing ultrasonic or radiographic examinations is not practical for the identified configuration, the licensee proposed to conduct leak monitoring by visual inspection each shift. The licensee has also performed an augmented inspection on other RRU units as specified in GL 90-05.

3.0 CONCLUSION

The staff has reviewed the licensee's request for relief and finds that the licensee has followed the analytical methods in accordance with ANSI B31.1 (1977). In addition, the staff performed an independent LEFM evaluation of the flawed component. Based on the analysis performed by the licensee and the staff, the flaw in the inlet stub connection joint satisfies the evaluation criteria in GL 90-05. Further, the staff finds that performing a Code repair on the leaking RRU-8 inlet stub connection while the Unit is operating is impractical. The staff concludes that the granting of relief where Code requirements are impractical and imposing alternative requirements is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest, giving due consideration to the burden upon the licensee and facility that could result if the Code requirements were imposed on the facility. Pursuant to 10 CFR 50.55a(g)(6)(i) and consistent with the intent of guidance in GL 90-05, relief is granted through the next refueling outage scheduled to start in 2001.

Principal Contributor: S. Sheng

Date: December 5, 2000

Vermont Yankee Nuclear Power Station

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