



CONNECTICUT YANKEE ATOMIC POWER COMPANY

TELEPHONE
203-665-5000

BERLIN, CONNECTICUT
P.O. BOX 270 HARTFORD, CONNECTICUT 06141-0270

December 6, 1985

Docket No. 50-213
B11903

Director of Nuclear Reactor Regulation
Attn: Mr. Christopher I. Grimes, Director
Integrated Safety Assessment Project Directorate
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Haddam Neck Plant
Proposed Revision to Technical Specifications
Steam Generators

Pursuant to 10CFR50.90, Connecticut Yankee Atomic Power Company (CYAPCO) hereby proposes to amend Operating License No. DPR-61 for the Haddam Neck Plant by incorporating the attached changes into the plant Technical Specifications. The proposed changes revise Technical Specification 4.10.1 - Inservice Inspection of Steam Generator Tubes to allow sleeving as a means to repair steam generator tubes and to include "pitting" as a mechanism causing steam generator tube degradation.

Background

By letter dated July 19, 1985⁽¹⁾ CYAPCO provided the NRC Staff with information concerning the activities planned for the 1986 refueling outage which will assure continued operability of the steam generators. One of the activities planned is to install sleeves inside defective tubes, thereby reducing the number of tubes which may be required to be taken out of service if the pitting corrosion identified during the last refueling outage has progressed substantially. Sleeving was successfully performed on the Millstone Unit No. 2 steam generators during the 1983 and 1985 refueling outages. The Haddam Neck Technical Specifications only allow steam generator tube plugging as a corrective measure for defective tubes. Therefore, this license amendment request to allow sleeving is necessary.

Description

The repair process requires that sleeves be inserted inside defective steam generator tubes in a manner to completely span the defective tube region.

- (1) J. F. Opeka letter to J. A. Zwolinski, dated July 19, 1985 discussing CYAPCO's plans to sleeve and plug steam generator tubes.

8512190004 851206
PDR ADOCK 05000213
P PDR

AD - D. CRUTCHFIELD (ltr only)
EB (W. JOHNSTON)
RSG (THOMAS)
EICSB (PARR)
FOB (W. REGAN)

ADD:

Acc 1
3/37

Plastic expansion of the sleeve against the tube, at the top and bottom of the sleeve, provides a leak limiting joint which exhibits sufficient mechanical strength to withstand normal operating, test and postulated accident loading conditions. Figure 1 shows a typical repair configuration. The expanded sleeve forms a new section of the reactor coolant pressure boundary.

The repair process involves honing of the defective steam generator tube in the region to be sleeved and installation and mechanical expansion of the sleeve. An eddy current test is then conducted to establish that the joint is properly expanded and accurately located. This examination also provides baseline data for future eddy current test examination.

The repair program will be conducted in accordance with ASME Section III, 1980 Edition through Winter 1980 Addenda, and meet the provisions of the original equipment specification;⁽²⁾ Regulatory Guide 1.83 - Steam Generator Tubing Inspectability; and Regulatory Guide 1.121 - Steam Generator Tube Plugging Margin. This repair program will be conducted under jurisdiction of ASME Section XI, 1980 Edition through Winter 1980 Addenda.

The tube repair program planned for the Haddam Neck steam generators is essentially identical to that utilized for the Millstone Unit No. 2 steam generators during the 1983 and 1985 outages. Furthermore, sleeve installation will be conducted in accordance with Northeast Utilities Service Company (NUSCO) Specification SP-ME-518 which establishes that:

- o The upper and lower mechanical joints have been qualified by design, analysis and design verification testing to ensure leak tightness, pressure retaining/load carrying capability for normal and faulted design loading conditions, and adequate resistance to potential stress-corrosion cracking and general corrosion concerns.
- o All qualified process/installation parameters will be monitored during installation to ensure compliance with established acceptance limits and design objectives.
- o The tube sleeves were designed in accordance with applicable ASME III fatigue requirements to ensure structural adequacy of sleeves for remaining service lifetime.
- o The hard rolling of the bottom tube sleeve joint will not degrade the tube-to-tube sheet weld.
- o The tube sleeves were sized to minimize sleeve/tube interaction and loading on the upper joint.

(2) The original design bases for Connecticut Yankee (CY) steam generators include the Safety Technical Specifications; Facility Description and Safety Analysis; Combustion Engineering, Inc. Report No. 1090: Analytical Report for CY Reactor Vessel, January 1965; Westinghouse Electric Corporation Technical Manual 1440-C78 for Model 27 Steam Generator, December 1966; Westinghouse Report WNEP-8521: CY Steam Generators Stress Report, April 1, 1985; and ASME Code Case No. 1270N.

- o All sleeves are shop hydrotested in excess of 3,000 psig, in lieu of the minimum required 1,000 psig test, to ensure structural integrity/leak tightness.
- o Additional shop NDE and metallurgical inspections were implemented to ensure tube sleeve material soundness.
- o The tube sleeve extends a minimum of 1 inch above the top joint strictly to prevent a potential double-ended tube rupture.
- o The design provides for automatic and hands-on sleeve installation.
- o The tube sleeve design minimizes increase to primary flow resistance.
- o The structural integrity of the existing steam generator tubes will not be degraded by the tube sleeve installation.

The Millstone Unit No. 2 reports⁽³⁾⁽⁴⁾ in conjunction with numerous other reports available in the literature also establish that the corrosion resistance of Inconel 690 sleeves will be superior to the mill-annealed Inconel 600 tubes that currently exist in the Haddam Neck steam generators.

The Haddam Neck sleeving qualification report will be submitted under separate cover by December 16, 1985. This report will provide the necessary analytical and test data to verify that Inconel 690 sleeves can be used in the Haddam Neck steam generators.

CYAPCO has reviewed the attached proposed change pursuant to the requirements of 10CFR50.59 and has determined that it does not constitute an unreviewed safety question. The basis for this determination is discussed below.

Safety Evaluation

Effect of Design Basis Accident Analysis

Steam generator tube repair, whether by plugging or sleeving, increases the flow resistance through that steam generator, decreases the available heat transfer area and reduces the volume of primary coolant. Therefore, there are limits to the number of steam generator tubes that can be repaired without affecting the assumptions made in the accident analysis.

Calculations show that the 9% core bypass flow assumed in the original Haddam Neck accident analyses was excessively conservative. Recent calculations by the original NSSS vendor show that the bypass flow can be reduced from 9% to 4.5% and still be conservative. This 4.5% bypass flow reduction and a proposed

(3) W. G. Council letter to R. A. Clark, dated June 3, 1983 transmitting Westinghouse Report WCAP-10267, "Millstone Unit No. 2 Steam Generator Sleeving Report."

(4) Supplemented information was supplied in W. G. Council letter to J. R. Miller, dated November 17, 1983.

change to the moderator temperature coefficient Technical Specification provide sufficient margin to allow up to 500 equivalent plugged tubes per steam generator (a total of 2,000 equivalent plugged tubes) without requiring new transient analyses. CYAPCO is currently projecting the need to sleeve 650 tubes and plug 135 tubes. This projection is based on previous eddy current test data and projected progression rates based on pitting corrosion experienced at Haddam Neck and Millstone Unit No. 2. Therefore, the present accident analyses remain bounding and there is no need to perform new accident or transient analyses.

Large break loss of coolant (LBLOCA) calculations have been performed and have included the effects of steam generator sleeving and plugging. Proposed Technical Specification changes to revise allowable peak linear heat generation rates and axial offset operating limits will be submitted based on results of the LBLOCA calculations. These proposed Technical Specification changes and a change to the reactor coolant system flow rate Technical Specification will be included in the proposed reload license amendment which will be submitted under separate cover. As stated previously,⁽¹⁾ the results of the evaluations and calculations will be provided with the sleeving qualification report by December 16, 1985.

Because of the above assessments, this proposed Technical Specification change will not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report.

Potential for Creation of an Unanalyzed Accident

Repair of steam generator tubes by sleeving reduces the probability of tube rupture due to wall thinning by corrosion. Regardless of this increase in safety, generic and exceptional failures can be postulated. These failures are reviewed with respect to effect, and preventative safeguards are noted.

The most serious safety implications arise from generic failures. Incorrect sleeve installation or design could result in an accident equivalent to a multiple tube rupture. For example, if the sleeve joints were partially expanded and not rolled, the potential for multiple sleeve ejection would exist. Besides the resulting loose parts, many defective tubes would then be exposed to the primary system fluid which could then leak into the secondary system. Incorrect design could lead to the same result by ignoring an important loading condition.

Because such generic failures could have severe safety consequences, a great deal of attention has been paid to design and installation aspects of the tube repair program. The design bases, compliance documents and installation procedures will be reviewed in detail to assure that no generic failures will occur. Northeast Utilities Quality Assurance plan will be used to assure that sleeves are fabricated and designed correctly. Thus, generic failures are essentially precluded.

Failures may be postulated which would not occur to all the sleeves but would be unique to a specific sleeve. This would include a single fabrication defect or incorrect installation. Single sleeve ejection with a tube rupture is the worst postulated failure.

Safeguards for exceptional failures are provided by multiple inspections for both as-fabricated and as-installed sleeves. Every sleeve is inspected after fabrication by non-destructive means (visual, dimensional, ultrasonic, hydrostatic, and eddy current). Destructive examinations are performed on laboratory mock-ups on a sampling basis. Visual inspections for shipping damage are performed at the site. After installation, every sleeved tube is eddy current tested and the results are checked by vendor and NU Quality Control. Finally, the secondary system is filled and pressurized to identify any leaking tubes.

Because of the extensive qualification process, sleeve specification, inspection and testing, and controls on sleeve installation, these failure modes are considered to be improbable.

As a result, this proposed Technical Specification change does not create the possibility of an accident or malfunction of a different type than any evaluated previously in the safety analysis report.

Effect on the Margin of Safety

The design specification for the sleeves, the sleeve inspection, sleeve testing, and installation procedures will result in a repaired steam generator tube which is structurally sound. The repaired tube will provide a pressure boundary function which meets all necessary requirements. Therefore, repairing steam generator tubes by sleeving will not be detrimental to public health and safety.

Therefore this proposed Technical Specification change does not reduce the margin of safety as specified in the basis of any technical specification.

Summary and Conclusion

Because of the above assessments, the changes implemented by this proposed Technical Specification change are considered to be safe and do not constitute an unreviewed safety question, as defined in 10CFR50.59 since it does not:

1. Increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report,
2. Create the possibility for an accident or malfunction of a different type than that previously analyzed in the safety analysis report, or
3. Reduce the margin of safety as defined in the technical specifications.

ALARA Considerations

The CYAPCO has taken into account ALARA considerations for each of the activities required in the steam generator sleeving and plugging program at Haddam Neck. ALARA activities specifically directed to reduction of occupational radiation doses include decontamination of steam generator channel heads, special shielding to reduce exposure to personnel during channel head and tube sheet operations, a control ventilation system for the channel heads and other surrounding work areas, special tools designed for high radiation areas, TV and audio surveillance of all platform and channel head operations, and personnel

training in full-size mock-ups. CYAPCO has verified the training program is in accordance with Regulatory Guides 8.27, 8.29 and 8.13 or equivalent. In addition, CYAPCO and its sleeving contractor, Westinghouse, make extensive use of classroom and mock-up training for individuals who perform sleeving operations.

CYAPCO estimates the total collective dose will be 518 person-rem for the Haddam Neck steam generator inspection and repair activities. This collective dose will include all occupational doses resulting from the sleeving operation including all site and contractor support personnel. CYAPCO estimates that 90% of the dose will be received by technicians (platform and channel head workers).

A breakdown of each task by estimated dose is provided as follows:

Tube Plugging	64 person-rem
Tube Sleeving	300 person-rem
Eddy Current Testing	47 person-rem
Decontamination	60 person-rem
Other Activities*	47 person-rem
Total	518 person-rem

* Other activities include man-way removal and installation, nozzle dam installation and removal, tube pulling, and platform preparation.

Significant Hazards Consideration

In accordance with 10CFR50.92, CYAPCO has reviewed the attached proposed changes and has concluded that they do not involve a significant hazards consideration. The basis for this conclusion is that the three criteria of 50.92(c) are not compromised, a conclusion which is supported by our determination made pursuant to 10CFR50.59. The Commission has provided guidance concerning the application of the standards in 10CFR50.92 by providing certain examples (April 6, 1983, 48 FR 14870) of amendments that are considered not likely to involve significant hazards considerations. Example (i) relates purely to a administrative change to the Technical Specification. For example, a change to achieve consistency throughout the Technical Specifications, correction of an error, or a change in nomenclature. Example (vi) relates to a change which either may result in some increase to the probability or consequences of a previously analyzed accident or may reduce in some way a safety margin, but where the results of the change are clearly within all acceptable criteria with respect to the system or component specified in the Standard Review Plan. For example, a change resulting from the application of a small refinement of a previously used calculational model or design method. The changes discussed above are similar to examples (i) and (vi) of 48 FR 14870 and thus do not involve a significant hazards consideration. The following is a detailed description of how each of the changes discussed above are similar to the examples of 48FR14870.

The change to the definition of degradation in Technical Specification 4.10.1.D.1.b recognizes the phenomena of pitting as a mechanism causing steam generator tube degradation and is similar to example (i). The change to Technical Specification 4.10.1.D.2 will allow sleeving as a means to repair steam generator tubes and is similar to example (vi). The change to

Technical Specification 4.10.1 Sections D.1.3, D.1.f, E, the bases, and Table 4.10.1-2 provide consistency throughout the Technical Specification and is similar to example (i). Based on the above considerations, CYAPCO has determined that these changes do not involve a significant hazards consideration.

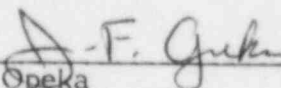
In accordance with 10CFR50.91(b), CYAPCO is providing the State of Connecticut with a copy of this proposed amendment.

The Haddam Neck Nuclear Review Board has reviewed and approved this proposed amendment and has concurred with the above determinations.

Pursuant to the requirements of 10CFR170.12(c), enclosed with this amendment request is the application fee of \$150.00

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY



J. F. Opeka
Senior Vice President

cc: Mr. Kevin McCarthy
Director, Radiation Control Unit
Department of Environmental Protection
State Office Building
Hartford, Connecticut 06116

Dr. Thomas E. Murley
Regional Administrator
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me J. F. Opeka, who being duly sworn, did state that he is Senior Vice President of Connecticut Yankee Atomic Power Company, Licensees herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Licensees herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.



Notary Public
My Commission Expires March 31, 1988

NORTHEAST UTILITIES



THE CONNECTICUT LIGHT AND POWER COMPANY
 THE MAINE CENTRAL ELECTRIC COMPANY
 THE NEW HAMPSHIRE POWER COMPANY
 THE VERMONT ELECTRIC COMPANY
 THE NEW JERSEY POWER AND LIGHT COMPANY

Connecticut Yankee Steam Generator Tube Repair Safety Evaluation for Structural Integrity

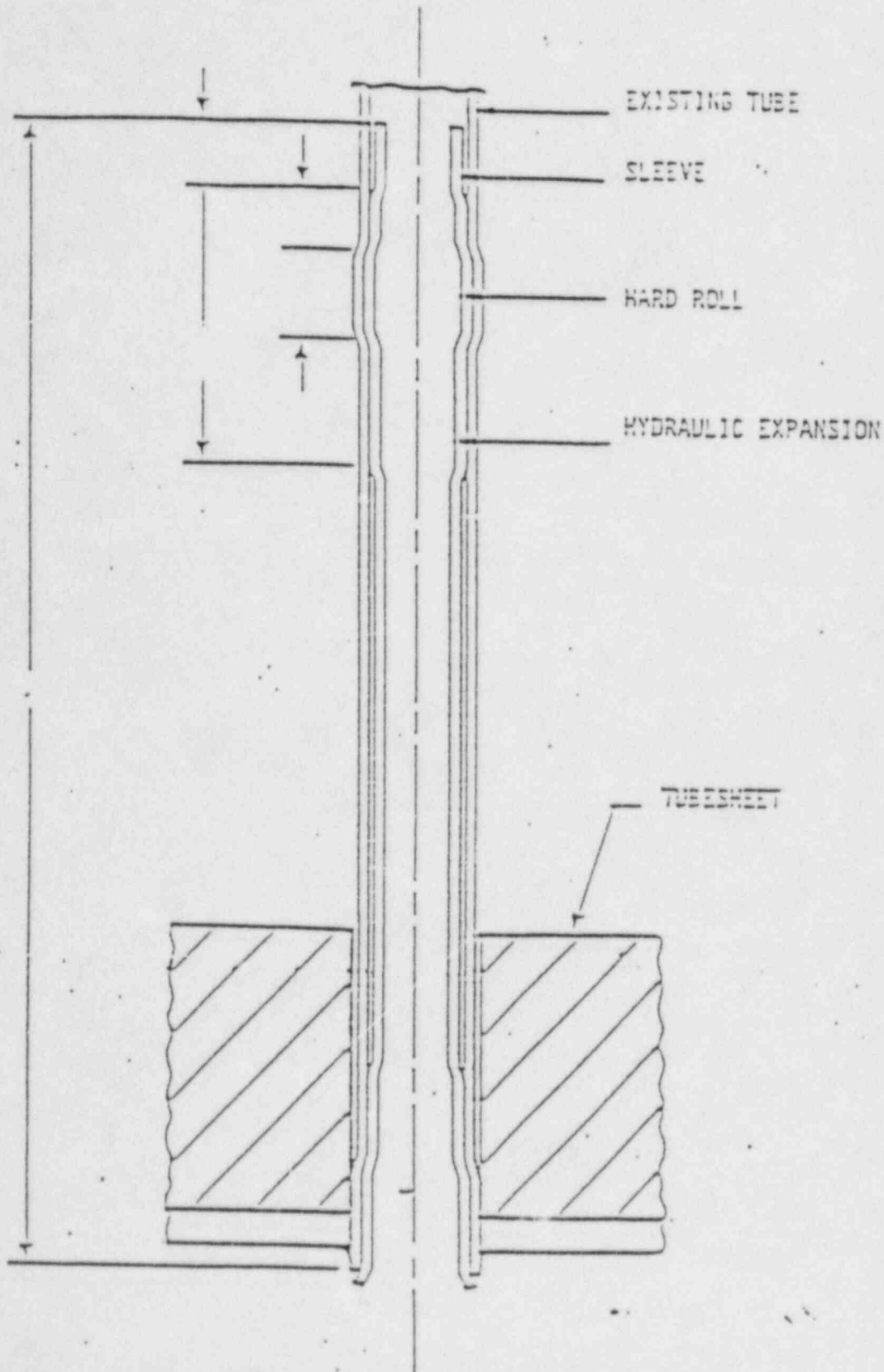


Figure 1: Cross-section of repaired steam generator tube