V

QUESTION REQUEST FORM
ENVY NRC 2004 INSPECTION

REQUEST# 274 DATE 8-26-04

NRC INSPECTOR Fred Bower

ENVY COUNTERPART: Enrico J. Betti

ENVY ASSIGNED PERSON Enrico J. Betti

Info Request☒ Question ☒ Potential CR☐

QUESTION/REQUEST:

Feedwater Nozzles

1. Request. Provide a copy of BVY 01-02, Letter VY to NRC, Alternate Feedwater Nozzle Inspection, January 16, 2001.
   Response: Copy attached below.

2. Request. Provide a copy of FVY 82-105
   Response: Copy attached below.

3. Question. Did BVY 01-02 supercede FVY 82-105.
   Response. Yes. There was an intermediate relief request [VY 94-07] from the requirements of NUREG-0619 granted in 1994 NVY 95-142 (also attached). In BVY 01-02 we notified the NRC that we would be inspecting the feedwater nozzles in accordance with BWR Owners' Group Licensing Topical Report, "Alternate BWR Feedwater Nozzle Inspection Requirements," GE-NE-523-A71-0594, Revision 1, August 1999. The NRC SER and Report have been attached.

4. Request. Provide a walkdown of CAB 25-9.
   Response. Walkdown will be performed to suit your schedule.

5. Question. How frequently do you develop and provide reports of Feedwater Leakage Monitoring Data Analysis?
   Response. The data is entered by Design Engineering on a monthly basis. The data is reviewed quarterly.

LIST OF ATTACHMENTS:

1. BVY 01-02, Letter VY to NRC, Alternate Feedwater Nozzle Inspection, January 16, 2001.
2. FVY 82-105, Feedwater Spargers, Response to NRC's Request for Additional Information, 9/21/82.
3. BVY 94-07 Request for Relief from NUREG-0619, 2/11/94.

FLS

4. NVY 95-142, Letter NRC to VY, Feedwater Inspection Relief Request, 10/12/1995.
5. BWR Owners' Group Licensing Topical Report, "Alternate BWR Feedwater Nozzle Inspection Requirements," GE-NE-523-A71-0594, Revision 1, August with NRC SER 3/10/2000.

RESOLUTION COMPLETE: _____ YES _____NRC Review

8/26/04
ENVY ASSIGNED PERSON SIGNATURE / DATE

8/24/04
INDEPENDENT TECH REVIEW / DATE
(N/A FOR DOCUMENT REQUEST)

8/26/04
ENVY TEAM LEADER / DATE

8/27/04
DATABASE UPDATED / DATE

*NOTE:
- INFORMATION PROVIDED TO THE NRC IS ONLY AFTER ENVY TEAM LEADER SIGNATURE
- VY TEAM LEADER DECIDES WHO IT WILL BE ASSIGNED QUESTION/REQUEST
- RETURN SIGNED OFF FORM TO ADMINISTRATIVE SUPPORT FOR DATABASE UPDATE.

6. Copy of Logic Detection Report
For Cycles 25, 24, 23
Plot of TC Temps ≥98% Power.

VERMONT YANKEE
NUCLEAR POWER CORPORATION

185 OLD FERRY ROAD, PO BOX 7002, BRATTLEBORO, VT 05302-7002
(802) 257-5271

January 22, 2001
BVY 01-02

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

References:
(a) Letter, USNRC to VYNPC, "Feedwater Nozzle Inspection Relief Request – Vermont Yankee Nuclear Power Station (TAC No. M92940)," NVY 95-142, October 12, 1995
(b) NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking," November 1980
(c) BWR Owners Group Topical Report, GE-NE-523-A71-0594, Revision 1, "Alternate BWR Feedwater Nozzle Inspection Requirements," August 1999
(d) Letter USNRC to BWROG, "Final Safety Evaluation of BWR Owner's Group Alternate Boiling Water Reactor (BWR) Feedwater Nozzle Inspection (TAC No. MA6787)," March 10, 2000
(e) NEI 99-04 [Revision 0], "Guidelines for Managing NRC Commitment Changes," July 1999
(f) Letter, USNRC to Licensees, "NRC Regulatory Issue Summary 2000-17, Managing Regulatory Commitments Made by Power Reactor Licensees to the NRC Staff," NVY 00-97, September 21, 2000

Subject: **Vermont Yankee Nuclear Power Station**
License No. DPR-28 (Docket No. 50-271)
Alternative Feedwater Nozzle Inspection

Pursuant to a request by Vermont Yankee (VY), the NRC staff concluded by letter dated October 12, 1995 [Reference (a)] that a feedwater nozzle inspection program using automated ultrasonic examination (UT) once every four refueling outages is acceptable for use at the Vermont Yankee Nuclear Power Station. Feedwater nozzle inspections conducted in accordance with this method meet the intent of NUREG-0619 [Reference (b)] and provide an acceptable level of quality and safety. Ultrasonic examinations of this type were first performed at VY in 1995 from the ID, and are due to be performed again during the 2001 refueling outage.

In addition to UT examinations of the feedwater nozzles, VY also performs visual examinations of the feedwater spargers, tracks thermal cycles, and monitors for thermal sleeve leakage.

Recognizing improvements in modern inspection technology, combined with updated plant-specific fracture mechanics assessments, the BWR Owners Group (BWROG) proposed [Reference (c)] an alternative to the recommendations set forth in NUREG-0619. In Reference (d), the NRC staff determined that the inspection program proposed by Reference (c) is an acceptable alternative to the inspection guidelines of NUREG-0619. VY concurs with this finding.

Therefore, VY intends to inspect the feedwater nozzles in accordance with Reference (c) during the upcoming 2001 refueling outage. For that inspection, the UT examination will be conducted from outside the reactor vessel (on the OD) and will conform to the conditions established in the BWROG topical report. Future UT examinations of feedwater nozzles may again be performed from the ID, in accordance with Reference (c). Decisions on whether future inspections will be conducted from the OD or ID will depend upon then existing considerations, such as ALARA principles and outage efficiencies.

VY intends to conduct its ongoing feedwater nozzle inspection program in compliance with Reference (c). In particular, VY will perform the examinations using an ultrasonic technique qualified in accordance with Paragraphs 4.3, 4.4, and 4.5 of said document until such time that the ASME Section XI, Appendix VIII performance demonstration rules take effect. Re-inspection frequency will be based on the criteria in Table 6-1 of the BWROG topical report, using the inspection interval factor for an interference fit, clad nozzle. VY will also continue to account for feedwater nozzle thermal cycles and conduct visual inspections of the feedwater spargers.

The BWROG topical report does not require leakage monitoring, or the reporting of leak detection data or results to the NRC staff. However, it has been VY's on-going practice to informally report this information to NRC staff each month. Because other methods exist to better assess feedwater nozzle integrity, VY is eliminating the practice of reporting these feedwater nozzle thermocouple data to the NRC staff; however, VY will continue to monitor for feedwater nozzle thermal sleeve leakage and would take the appropriate corrective actions if adverse conditions are detected.

Inspections performed since replacing the VY feedwater spargers in 1976 have shown no new cracking of the VY feedwater nozzles. In addition, we are not aware of any new cracking of BWR feedwater nozzles in the industry over the past 15 years, indicating the effectiveness of measures taken to reduce thermal stresses, which could cause crack propagation and growth.

VY has updated the related fracture mechanics analysis and crack growth projections to include a more conservative temperature correlation at the nozzle inner surface. This correlation bounds potential bypass leakage effects and crack growth rates under postulated system thermal cycling events. VY's approach to calculating postulated crack growth is based on bounding temperature data, conducting UT and visual inspections, and monitoring thermal cycles.

Summary

Future examinations of VY's feedwater nozzles will be conducted in accordance with Reference (c). This approach (1) has been approved by NRC staff, (2) provides sound technical methods to assure the integrity of the feedwater nozzles, and (3) provides an acceptable level of quality and safety.

This change has been evaluated in accordance with VY's program for managing regulatory commitments, and VY has determined that prior NRC approval is not required. This program is consistent with the methodology of Reference (e), which the NRC staff has found to be an acceptable way to control regulatory commitments [Reference (f)]. If there are any questions about this matter, please contact Mr. Jim DeVincentis at (802) 258-4236.

Sincerely,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Don M. Leach
Vice President, Engineering

cc: USNRC Region 1 Administrator
USNRC Resident Inspector – VYNPS
USNRC Project Manager – VYNPS
Vermont Department of Public Service

SUMMARY OF VERMONT YANKEE COMMITMENTS

BVY NO.: 01-02

The following table identifies commitments made in this document by Vermont Yankee. Any other actions discussed in the submittal represent intended or planned actions by Vermont Yankee. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Licensing Manager of any questions regarding this document or any associated commitments.

COMMITMENT	COMMITTED DATE OR "OUTAGE"
Perform ultrasonic inspections of feedwater nozzles in accordance with BWROG Topical Report GE-NE-523-A71-0594, Revision 1	Every fourth refueling outage, beginning Spring 2001

Incoming NRC Correspondence

VERMONT YANKEE LICENSING CORRESPONDENCE/COMMITMENT CONTROL SHEET

DESCRIPTION: **Letter, D.H. Dorman (USNRC) to D.A. Reid (VYNPC)**

SUBJECT: **Feedwater Nozzle Inspection Relief Request - VYNPS**

SUMMARY: **Letter provides NRC approval of VY's Feedwater Nozzle Inspection technique and inspection interval.**

The NRC reviewed the final qualification report submitted by VY in July 1995 and concludes that the automated UT qualification is acceptable for use by VY as requested for examination of the feedwater nozzles once every four refueling outages. The NRC further stated that Feedwater nozzle inspections with this method, conducted on at least once every four refueling cycles, meet the intent of NUREG-0619 and provide an acceptable level of quality and safety.

DOCUMENT NUMBER: NVY 95 - 142 DOCUMENT DATE: 10/12/95 NO. PAGES: 3

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 12, 1995
NVY 95-142

RESPONSIBILITY

Mr. Donald A. Reid, Vice President
Operations
Vermont Yankee Nuclear Power Corporation
Ferry Road
Brattleboro, VT 05301

SUBJECT: FEEDWATER NOZZLE INSPECTION RELIEF REQUEST - VERMONT YANKEE NUCLEAR POWER STATION (TAC NO. M92940)

Dear Mr. Reid:

By letter dated February 11, 1994, Vermont Yankee Nuclear Power Corporation (VYNPC) requested relief from the dye penetrant (PT) requirement and the ultrasonic examination (UT) schedule contained in NUREG-0619, as modified by Generic Letter 81-11. VYNPC proposed to perform an automated ultrasonic examination of the feedwater nozzles from the inside of the reactor vessel in lieu of the PT examination at intervals not to exceed every fourth refueling cycle. By letter dated November 8, 1994, VYNPC submitted a fracture mechanics evaluation and additional information on the inspection technique qualification program. In a letter dated February 6, 1995, the NRC staff concluded that VYNPC may use the proposed UT inspection technique in lieu of PT examination for the feedwater nozzles during the 1995 refueling outage. The staff also indicated in its February 6, 1995, letter that final approval of VYNPC's proposed inspection technique and interval was dependent upon the results of the final UT technique qualification, and that the staff would review the results from the completion of the qualification program when available and issue a final evaluation.

NRC Inspection Report No. 50-271/95-09 documented the results of the spring 1995 feedwater nozzle inspections. VYNPC found no recordable indications and no surface breaking cracks extending into the base material. The NRC inspector concluded that VYNPC conducted a thorough qualification process and a high quality inspection.

By letter dated July 14, 1995, VYNPC submitted the final qualification of the UT inspection technique for feedwater nozzles. This letter contained the final qualification report, dated June 20, 1995, from the Electric Power Research Institute (EPRI) Nondestructive Examination (NDE) Center to Yankee Atomic Electric Company. The EPRI NDE Center concluded that the ultrasonic procedures and equipment used by VYNPC successfully demonstrated the system's capabilities for flaw detection and sizing.

The staff has reviewed the final qualification report and concludes that the automated UT qualification is acceptable for use by VYNPC as requested for examination of the feedwater nozzles once every four refueling outages,

because the capabilities of the inspection technique are within the asssumptions of the fracture mechanics analysis. Feedwater nozzle inspections with this method, conducted at least once every four refueling cycles, meet the intent of NUREG-0619 and provide an acceptable level of quality and safety.

If you have any questions on this matter, please contact me at (301)415-1429.

Sincerely,

Daniel H. Dorman

Daniel H. Dorman, Project Manager
Project Directorate I-3
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-271

cc: See next page

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Outgoing NRC Correspondence

VERMONT YANKEE LICENSING CORRESPONDENCE/COMMITMENT CONTROL SHEET

DESCRIPTION: **Letter, J.P. Pelletier (VYNPC) to USNRC**

SUBJECT: **Request for Relief from NUREG-0619 Inspection Requirements**

SUMMARY: **Letter requests relief from the PT examination requirement and the ultrasonic examination schedule contained in NUREG-1619, as modified by Generic Letter 81-11.**

VY has determined that reliable technology is now available to ultrasonically inspect the RPV feedwater nozzle inner radius and bore region.

DOCUMENT NUMBER: BVY 94-07 DOCUMENT DATE: 02/11/94 NO. PAGES: 8

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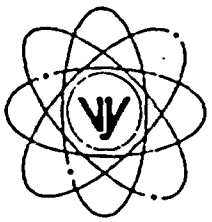

Ferry Road, Brattleboro, VT 05301-7002

REPLY TO
ENGINEERING OFFICE
580 MAIN STREET
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(508) 779-6711

February 11, 1994
BVY 94-07

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

References:
(a) License No. DPR-28 (Docket No. 50-271)
(b) NUREG-0619, BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking, dated 11/13/80
(c) USNRC Generic Letter 81-11 to all Power Reactor Licenses & License Applicants, dated 02/20/81

Subject: REQUEST FOR RELIEF FROM NUREG-0619 INSPECTION REQUIREMENTS

As a result of reactor vessel feedwater nozzle inner radius and bore cracking experienced in the period of 1974 through 1980, the NRC issued NUREG-0619, dated November 13, 1980 [Reference (b)]. The NUREG described the appropriate actions to minimize or eliminate feedwater nozzle cracking concerns. The NUREG concluded that implementation of the recommended actions was considered by the NRC to satisfactorily resolve the issue, with the exception of the development of improved nondestructive examination (NDE) techniques. Because of the state of ultrasonic testing (UT) technology in use at the time NUREG-0619 was issued, the NRC required periodic liquid penetrant (PT) examination at a frequency determined by the feedwater sparger design.

Vermont Yankee has determined reliable technology is now available to ultrasonically inspect the feedwater nozzle inner radius and bore region. Consequently, Vermont Yankee requests relief from the PT examination requirement and the ultrasonic examination schedule contained in NUREG-0619, as modified by NRC Generic Letter 81-11, [Reference (c)]. The relief request, the technical basis, and proposed alternative actions are provided in the enclosure. The proposed alternative action is to perform ultrasonic examination on the ID of the reactor vessel in a one inch annular space between the sparger thermal sleeve and the nozzle bore. This type of examination is superior to the typical ultrasonic inspection performed from the OD of the nozzle surface and vessel shell.

The PT examination is scheduled to be performed during the Spring 1995 refueling outage. The relief from the PT requirement will prevent the unnecessary personnel radiation exposure and expense involved in the performance of the PT examination and sparger removal. In lieu of the PT examinations, Vermont Yankee will perform automated, enhanced UT examinations from the inside of the reactor pressure vessel.

Vermont Yankee plans to request bids for this UT examination in February, 1994. The reason for this lead time is to give the vendor time to design a particular automated technique with adequate time allowed prior to the scheduled Spring 1995 examination. It is also recognized that 1994 and 1995 will be busier than usual for inspection vendors due to preparations for implementing requirements of ASME Section XI, Appendix VIII. The lead time is also desired to allow for the contingency to prepare for performing UT from the OD of the nozzle, if this becomes necessary.

Because of these scheduling factors, Vermont Yankee requests prompt consideration of this relief request.

We trust that the information provided herein adequately addresses our request. However, if you have any questions in this regard, please contact us.

Sincerely,

VT YANKEE NUCLEAR POWER CORP.

James P. Pelletier
Vice President, Engineering

JPP/gmv

Enclosure

cc: USNRC Region I Administrator
USNRC Resident Inspector - VYNPS
USNRC Project Manager - VYNPS

ENCLOSURE

NUREG-0619 - FEEDWATER NOZZLE EXAMINATION RELIEF REQUEST

REQUIREMENT FROM WHICH RELIEF IS REQUESTED:

NUREG-0619 was issued by the NRC for implementation by letter dated November 13, 1980 and was later modified by Generic Letter 81-11. NUREG-0619, Section 4.3.2, Table 2 specified inspection frequencies for the visual inspection of the sparger, and the liquid penetrant testing (PT) and ultrasonic testing (UT) of the feedwater nozzle inner radius and bore. These requirements replaced the American Society of Mechanical Engineers (ASME) Code Section XI requirements with more stringent requirements.

In a letter dated January 5, 1987, Vermont Yankee requested permanent relief from the invessel PT. The NRC granted a six fuel-cycle extension in a letter dated August 7, 1987 (a PT would be required in the Spring 1995 refueling outage), but did not grant permanent relief based on the following conclusions:

1. They did not have reasonable assurance and confidence that the UT method being employed would replace the PT method in accurately detecting minor surface flaws.

2. Stainless steel clad may lead to cracking due to normal aging processes and adversely affect the environment between the two dissimilar metals. The PT examination offers defense in depth.

3. As the reactor ages, the interference fit thermal sleeve may develop gaps which will eventually lead to cracks.

4. The feedwater nozzle is an integral part of the reactor vessel pressure boundary. It is important to the public safety to have a redundant PT examination of the nozzle.

Relief is being sought from the requirement to perform a PT examination of the feedwater inner radius and bore, and the schedule imposed by Table 2 of Section 4.3.2 for the performance of the UT examination. Relief is also requested from the requirement to remove or repair detected flaws if they can be shown to be acceptable for service.

BASIS FOR RELIEF

Background

Vermont Yankee has a single sleeve sparger design. According to NUREG-0619, Table 2, Vermont Yankee is required to ultrasonically inspect the feedwater nozzle inner radius every refueling outage and visually examine the sparger every two refueling outages. Vermont Yankee has followed this schedule since 1977. As noted above, the NUREG-0619 PT requirements were amended by the 1987 NRC letter. Under these new requirements, the next PT examination is to be done in 1995. In addition, as recommended by the NRC, a specially developed leak detection system was added in 1982. This system uses thermocouples to monitor vessel temperature at the nozzle metal surface to provide indication of thermal sleeve leak tightness. Vermont Yankee has been collecting and monitoring data from this system from 1982 through the present date.

Technical

The August 7, 1987 letter from the NRC to Vermont Yankee and Section 4.3.1 of NUREG-0619 states that the confidence in the UT capabilities available at the time the NUREG was issued was unacceptably low. NUREG inspection requirements were based on the technology in use at that time. The required inspection program included both UT and PT examination criteria. NUREG-0619 concluded that should future developments and the results of inservice UT examinations demonstrate that UT techniques can detect small thermal fatigue cracks with acceptable reliability and consistency, these techniques could form the basis for modification of the inspection criteria.

Since the issuance of NUREG-0619 and since Vermont Yankee's last request for exemption in 1987, improvements in the area of UT, both manual and automated, have occurred. Automated UT techniques are capable of detecting and sizing small (0.25" deep in the base material and smaller) fatigue cracks. Furthermore, technology has progressed to where UT can be performed in very small spaces. An ID examination in the one inch gap between the sparger and the nozzle bore (the sparger reduces down at the interference fit) will give excellent sensitivity to small flaws, much better than typically achieved on an OD examination. Small cracks can be detected and sized, even with the cladding present in the inner radius. Although a special manipulator will be necessary, this type of technology has been proven in PWR nozzle inner radius inspections.

Given that the PT requirements were due to a lack of confidence in the available UT techniques, and that the new enhanced automated UT techniques can now adequately examine the areas of concern, the PT requirement is unwarranted. Therefore, modifying the inspection criteria is justifiable.

Performance of a PT examination on the inner radius constitutes an undue burden without providing a commensurate increase in safety.

- Due to the high frequency nature of high cycle mixing, it is expected that once started, the shallow cracks progress to the 0.25" depth very quickly--in a matter of months. Because of the postulated rapid initial growth, it does not make sense to attempt to detect flaws smaller than this value, such as could be detected by PT.

- Clad cracking alone does not necessarily indicate active fatigue crack growth. IGSCC clad cracking has been seen frequently in many vessels. Therefore, PT examination will only serve to confirm the existence of cracking in the nonstructural (cladding) portion of the vessel. The radiation exposure and expense of removing PT indications, which may be benign, is unwarranted.

- Additionally, performance of a PT examination in accordance with NUREG-0619 requires that if any cracks are detected, all spargers are to be removed, and all nozzles inspected and repaired as necessary. There is a high likelihood that clad cracking would be detected due to IGSCC in the stainless clad, thus forcing sparger removal. Removal of flaws would be very difficult, if not impossible, in the one inch gap. This will involve substantial personnel radiation exposure, significant effort to remove spargers, and a high cost for the re-installation of spargers.

- Vermont Yankee estimates that there would be an accumulation of 10 manRem to PT only the accessible areas of the four nozzle inner radii. To additionally remove and replace all four spargers would add an estimated dose of 100 manRem. The work would cost several million dollars. Performance of an automated ID UT would accumulate less than 1 manRem.

- The PT will not provide information as to the depth of detected flaws, and therefore their acceptability for service.

It is more prudent to take advantage of the sizing capability of the UT to track the growth of any identified flaws and take action when necessary. This is especially true in light of the fact that both Vermont Yankee's experience to date and the plant specific fracture mechanics analysis indicate that small cracks will grow very slowly with the current inconel interference fit thermal sleeve configuration.

The problem of internal surface cracking on BWR feedwater nozzles initiated extensive research concerning the nozzle cracking and bypass leakage in the late 1970's. This research determined that the fatigue effects of bypass leakage would be minimal if the quantity of leakage was low. At Vermont Yankee the original stainless steel thermal sleeves were machined to have an 0.004" average gap. In the original design calculations, GE calculated the bypass leakage with this gap to be in excess of 100 GPM. Therefore, in 1976 when the feedwater inspection and repair work was performed, a significantly improved design was used for the replacement thermal sleeves.

The original feedwater nozzle stainless steel thermal sleeves were replaced in 1976 with the Inconel interference fit assemblies. These assemblies were machined oversize, 0.010" $\pm$0.003", nitrogen cooled, and press fit into position. Inconel material was selected over stainless steel due to its more desirable thermal characteristics. Inconel has a lower coefficient of thermal expansion than stainless steel. The interference fit inconel sleeve will maintain a tighter fit than a sleeve made of stainless steel, significantly reducing or eliminating bypass leakage.

In 1982, Vermont Yankee added a specially developed leak detection system. This system uses thermocouples to monitor vessel temperature at the nozzle metal surface. During steady state conditions, when feedwater flow and reactor and feedwater temperature are constant, changes in metal temperature readings at these thermocouples are indicative of changes in bypass leakage. Vermont Yankee has monitored this system on a weekly basis since 1982.

It has been generally concluded, after much research on the feedwater nozzle fatigue cracking issue, that shallow cracks in the 0.25" and smaller range are primarily caused by high cycle mixing of reactor water and cooler feedwater. As mentioned previously, the high frequency nature of this mixing is expected to propagate shallow cracks to a depth of 0.25" through the cladding in a matter of months. At this point, the effect of high cycle mixing diminishes, and system cycling, such as heatup/cooldown or scram events, is required to cause further fatigue crack growth. Because system cycles such as scrams and heatup/cooldowns are typically infrequent, crack growth in this stage is at a much slower process.

Vermont Yankee has also developed a detailed fracture mechanics model to estimate future fatigue crack growth based on projected feedwater nozzle and reactor operating cycles, projected bypass leak rate, and flaw size.

Since Vermont Yankee's last relief request, specific evaluations to determine flaw growth over a startup/shutdown cycle for Vermont Yankee have been conducted using a conservative representation of startup/shutdown transients based on Vermont Yankee experience.

The allowable flaw size for the Vermont Yankee feedwater nozzles, determined using the methodology of ASME Section XI, was found to be 0.823", (0.635" subclad flaw depth considering the nominal 3/16" clad thickness).

Based on a flaw depth of 0.50" (0.312" in the base material), the plant specific fracture mechanics analysis concludes that it would require in excess of 35 startup/shutdown cycles before ASME Section XI allowable flaw size by analysis is reached. Because the UT exam method can confidently identify flaws in excess of 0.25" in the base metal, a 0.50" flaw size was used to envelope clad plus base metal flaw depths. Based on Vermont Yankee's recent operating record, it would require more than 5 operating cycles for an undetected flaw to grow to the ASME Section XI (by analysis) allowable flaw size of 0.823" (0.635" subclad flaw depth).

This evaluation indicates that if a UT examination is performed which can confidently identify flaws that are 0.25" or greater, and if no flaws are detected, then Vermont Yankee can safely operate many additional fuel cycles without exceeding the allowable 0.823" flaw size.

The manual UT examinations that have been performed to date at Vermont Yankee have not detected any recordable indications. The most recent examination (1992) was enhanced by using search units that were optimized using computer aided design (CAD). The technique is capable of detecting EDM notches in the Vermont Yankee feedwater nozzle mockup. There were no scanning restrictions for the manual UT examination.

It is Vermont Yankee's position that the combination of improved thermal sleeve design and improvements in feedwater system operation to minimize thermal cycling have successfully eliminated significant flaw growth in the reactor pressure vessel feedwater nozzles. Any additional invessel work, including PT examination, clad removal, or thermal sleeve replacement would only be warranted if additional flaw growth is detected.

Therefore, Vermont Yankee concludes that the nozzle cracking issue has been adequately addressed by:

1. Reducing or eliminating the flaw initiating leakage by replacement of the original sparger design with the improved press fit design.

2. Incorporation of the thermal leakage detection monitoring program.

3. Improving system operations to minimize thermal cycling.

4. Performing the enhanced manual UT examinations.

5. Showing by analysis that an assumed flaw even as large as 0.50" would not grow to exceed the allowable 0.823" in 35 startup/shutdown cycles.

ACTIONS IN LIEU OF REQUIREMENT

In lieu of draining the vessel to expose the nozzles, removing spargers as necessary, performing in-vessel PT examinations, and performing manual UT examinations from the vessel exterior every outage, the following plan is proposed:

1. Perform the automated UT in 1995 and at intervals not to exceed every fourth refueling cycle.

2. Future automated UT's will be performed at conservative intervals based on:

   a. Largest undetected flaw size.

   b. Projected startup/shutdown cycles.

   c. ASME allowable flaw size by calculations.

   d. Fracture mechanics crack growth model.

   The longest inspection interval will not exceed four operating cycles. In the event relevant service-induced indications are discovered in the inner radius or nozzle bore, the inspection frequency will be adjusted to ensure adequate tracking and assessment of those indications. The flaw size used for analysis purposes will be that determined by the ultrasonic sizing technique.

3. Maintain a cumulative account of the number of thermal cycles to ensure that current thermal duty is enveloped by the design basis duty used in the fracture mechanics flaw growth prediction and that additional analysis is initiated, if necessary.

4. Maintain the existing thermal leakage monitoring system program.

5. Continue to perform the in-vessel visual examination of the spargers on the current two cycle interval.

VERMONT YANKEE
NUCLEAR POWER CORPORATION

2.C.2.1
FVY 82-105

RD 5, Box 169, Ferry Road, Brattleboro, VT 05301

REPLY TO
ENGINEERING OFFICE
1671 WORCESTER ROAD
FRAMINGHAM, MASSACHUSETTS 01701
TELEPHONE 617-872-8100

September 21, 1982

2.C.2.1
5.3.1.1.

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing

References: (a) License No. DPR-28 (Docket No. 50-271)
(b) Letter, USNRC to VYNPC, NVY 82-129, dated August 10, 1982
(c) Letter, VYNPC to USNRC, FVY 82-60, dated May 27, 1982

Subject: Feedwater Spargers - Response to NRC's Request for Additional Information

Dear Sir:

R. C. Haynes
J. E. Tribble
D. E. Vandenburgh
L. H. Heider
D. W. Edwards/R. E. Helfrich
L. D. Marsolais — D. A. Reid
J. B. Sinclair — J. Ritsher
R. L. Smith — Mgr. of Nuc. Op-
J. G. Robinson — Bos. Ed.
W. F. Conway — J. Calhoun
R. Kenney — R. Saudek
A. M. Shepard-2 — J. Leaser
D. McCue (Copy 1) — Lic. File
W. P. Murphy — Chrono
J. P. Pelletier — NUS Corp.
R. W. Burke
R. E. Lapp
C. M. Rice
R. C. Staker
M. D. Lyster
D. Pagodin
J. Lance
R. E. White

Reference (b) requested Vermont Yankee to provide additional information and commitments with regard to our position that the presently installed feedwater spargers are performing well, and thus, do not warrant replacement in accordance with the guidance criteria established in NUREG-0619. The requested information, with the exception of our response to Item 1 of Reference (b), is provided in Attachment 1.

Our position that the existing feedwater spargers are adequate is based on the exceptional operating history at Vermont Yankee, as well as our proposed program of performance monitoring and periodic inspection of the present spargers. Specifically, the basis for our position includes:

- Liquid Penetrant inspections since installation of interference fit sparger thermal sleeve in 1976 indicate no cracking. Subsequently, little or no bypass leakage, which is necessary to initiate cracking, has occurred.

- Operating procedures which minimize feedwater flow cycling and transients.

- A significantly reduced number of crack propagating heatup/cooldown cycles since "mature" plant operation. A review of our records indicates that the number of heatup/cooldown cycles per year has been reduced by approximately 50 percent since the installation of the interference fit sparger thermal sleeve. (See Response to Item 6 of Attachment 1.)

- Installation of Bypass Leak Detection System in 1981 to monitor deleterious leakage. (See Response to Items 5 and 6 of Attachment 1.)

- Performance of relevant UT exams including development based on qualification testing. (See Response to Item 2 of Attachment 1.)

We believe that the operating history at Vermont Yankee coupled with the ongoing efforts to periodically inspect and assess the performance of the present feedwater spargers, demonstrates their adequacy.

Item 1 of the enclosure to Reference (b) requested that Vermont Yankee either commit to 1) conduct an NRC-approved Ultrasonic Test (UT) examination of the feedwater nozzle bore and blend radius regions; or 2) perform a liquid Penetrant Test (PT) examination of the accessible areas of all four feedwater nozzle blend radius regions. At the present time, it is our intent to perform a qualified UT examination of the feedwater nozzle blend radius region as well as an analytically developed UT examination of the nozzle bore during the 1983 refueling outage. This effort is discussed in more detail in our response to Item 2 of Attachment 1.

We believe that a qualified UT examination of the feedwater nozzle blend radius region will provide more than adequate assurance that the concerns of NUREG-0619 are addressed. In fact, because a PT examination was conducted during the previous refueling outage, a subsequent PT examination during the 1983 refueling outage is neither warranted nor called for by the guidelines of NUREG-0619. These guidelines indicate that such examinations need only be performed every thirty (30) startup/shutdown cycles. Thus, requiring an additional PT examination during the 1983 refueling outage would be more stringent than the already conservative guidance criteria spelled out in NUREG-0619.

It is our intent to perform the previously discussed UT examination during the 1983 refueling outage as part of our continuing developmental program. We are confident that performance of a qualified UT examination of the nozzle blend radius region will be more than adequate in assessing the performance of the existing spargers. Further, performance of a UT examination of the nozzle blend radius in lieu of a PT examination of the same nozzle region, will result in a significant reduction in exposure to the personnel performing the inspection.

Our plans to implement this program are currently underway. We trust that the information presented above is satisfactory; however, should you have any additional questions, please do not hesitate to contact us.

Very truly yours,

VERMONT YANKEE NUCLEAR POWER CORPORATION

L. H. Heider
Vice President

JBS:dd

RESPONSE TO NRC'S REQUEST FOR ADDITIONAL INFORMATION (RAI)

Item 2. Request

VY is requested to commit to take the necessary steps in advance of the 1983 refueling outage to ensure that the efficacy of the UT procedure used for the bore region has been demonstrated, including calibration. In addition, any UT indication evaluated as being a crack, must be evaluated by PT.

Response

As discussed in the cover letter, it is Vermont Yankee's intent to perform a qualified UT examination of the nozzle blend radius region only. This would consist of Vermont Yankee or our contractor using an existing nozzle mock-up (like Nine Mile Point-1) to demonstrate the nozzle blend region extent of coverage and examination criteria. The NMP-1 mock-up is adequate because the vessel shell dimensions and blend radius at VY and NMP-1 are similar. The mock-up testing will be utilized to develop minimum flaw detection capability.

UT examination of the nozzle bore will be developed by analytical methods. The demonstration of the nozzle bore exams will be based on proving the exam concept using the NMP-1 bore configuration. It is our intent that the blend radius and bore examinations will be further developed and finalized on a mock-up fabricated to represent the nozzle configuration at Vermont Yankee. This mock-up will not be available until the 1984 refueling outage.

Item 3. Request

Vermont Yankee is requested to report the results of any nondestructive examinations (PT, UT, and any other) performed during the 1983 refueling outage to the Director, Division of Licensing, NRC, within 30 days of the completion of the examinations.

Response

Vermont Yankee agrees to the provisions of this item.

Item 4. Request

Prior to the 1983 outage, VY is requested to submit all available leakage monitor data to the Director, Division of Licensing, NRC, in the format of Figures 1 and 2 of Enclosure 2 or other format if first approved by the NRC. The NRC Resident Inspector must be advised routinely (on a monthly basis would be best) as to the status of the properly reduced data. Further operation in the present configuration must be re-evaluated if any one of the following conditions occur:

(1) Deviation by more than 0.10 from the established constant (steady-state) value of normalized temperature (See Figures 1 and 2);

(2) Failure of more than 2 T/C on any one F/W nozzle; and

(3) Failure of more than 5 T/C of the 16 originally installed.

Response

Vermont Yankee agrees to the provisions of this item.

Item 5. Request

Certify as correct (or identify any errors) in writing to the NRC in the temperature data listed in Table I of Enclosure 3.

Response

In lieu of providing raw temperature data which can be misleading due to the varying plant conditions at the time temperatures are recorded, we are enclosing (Attachment 2) the normalized temperature data which has been tracked since startup to mid-August.

Since Commitment (4) of Reference (b) is addressed to normalized temperature limits, the curves provided will serve as our baseline data.

Normalized temperatures are defined as:

$$T_{NORM} = \frac{T_{T/C} - T_{FEEDWATER}}{T_{REACTOR} - T_{FEEDWATER}}$$

Item 6. Request

Certify as correct (or identify any errors) in writing to the NRC in the plant cyclic data shown in Figure 1 of Enclosure 3.

Response

The information, as presented in Figure 1 of Enclosure 3 is accurate as of April 1982. However, since we originally supplied you with the cyclic data via Reference (c), we have had three additional startup/shutdown cycles.

It should be noted that our previous use of startup/shutdown cyclic data is a very conservative indicator of thermal cycling. A heatup/cooldown cycle, which is defined as any startup or shutdown cycle during which the reactor coolant temperature changes more than 300° farenheit, provides a more accurate indication of actual thermal duty to the feedwater nozzles. To date, Vermont Yankee has

had 65 heatup/cooldown cycles, 28 of which have occurred since the installation of the interference fit sparger thermal sleeve in 1976.

Item 7. Request

Provide a commitment to follow a plan with respect to clad removal which meets the intents of the Task A-10 safety issue resolution, Sections 3 and 4, NUREG-0619.

Response

We will continue to monitor leakage bi-weekly and perform required inspections. When leakage trends show significant increase to a level where our analyses indicate unacceptable cladding/nozzle stresses for end of plant life, or inspections reveal unanticipated indications, we will make plans for corrective action at a subsequent outage including plans for sparger replacement, if deemed necessary.

At present, the best replacement design available for Vermont Yankee is the so-called "tuning fork" double sleeve sparger; however, if other improved designs are developed, we will also consider these in our choice for replacement.

Item 8. Request

The VY letter, dated May 27, 1982, in Item 2, Future UT Examinations stated that: "Results will be compared to previously obtained data." Since no data relating to the bore region were obtained, the statement must refer to the blend radius region only. Verify our interpretation of that statement, or correct it, as appropriate.

Response

Your interpretation of the statement is correct.

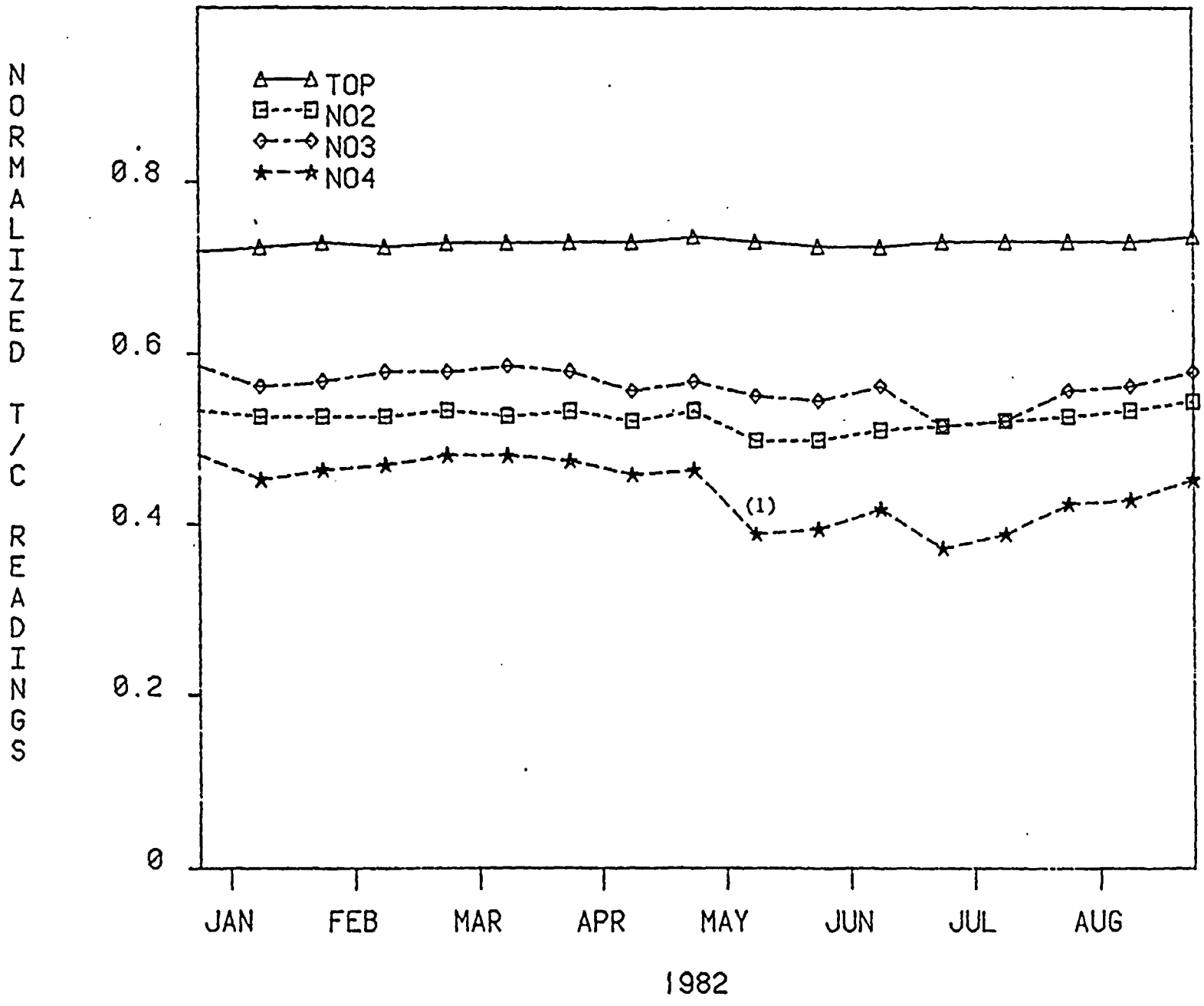
Item 9. Request

If it becomes necessary to refurbish to F/W nozzles at VY, we understand that the sparger/thermal sleeve design will be something akin to the one employed at Monticello. That is, the safe-ends will be replaced with a "tuning fork" shape and the thermal sleeve will be welded to the inside leg. The description, however, will be a "welded double sleeve", not "triple sleeve", as stated in the VY May 27, 1982 letter. Please clarify whether a "welded double sleeve", or a "triple sleeve", is expected to be used.

Response

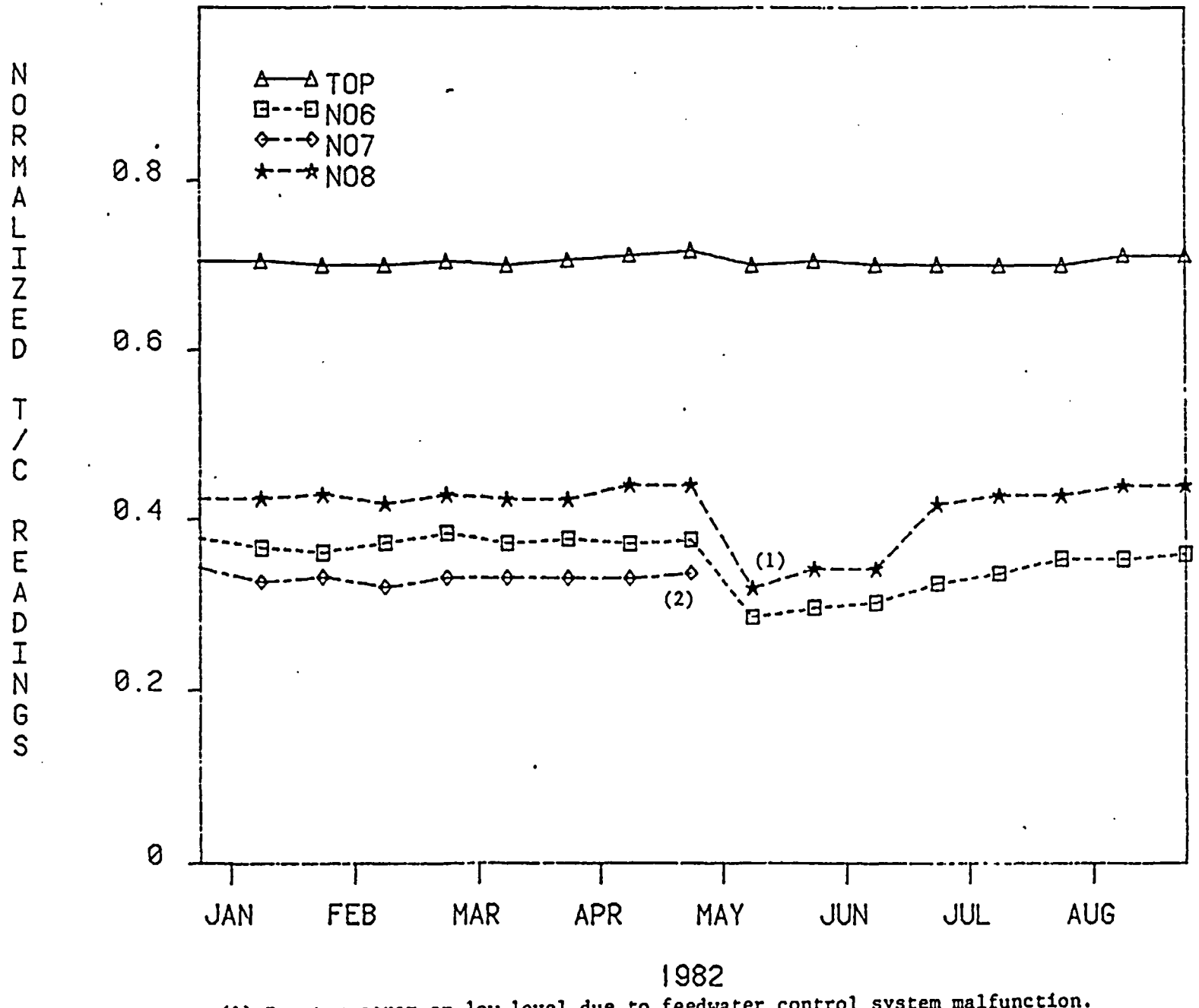
If feedwater sparger replacement eventually is required, with our present information, we would most likely choose a welded type of double sleeve sparger similar to that recently installed at Monticello. The General Electric designed double piston ring/triple sleeve sparger will not be used as it is incompatible with the Vermont Yankee nozzle geometry.

FEEDWATER NOZZLE TEMPERATURES
NOZZLE A



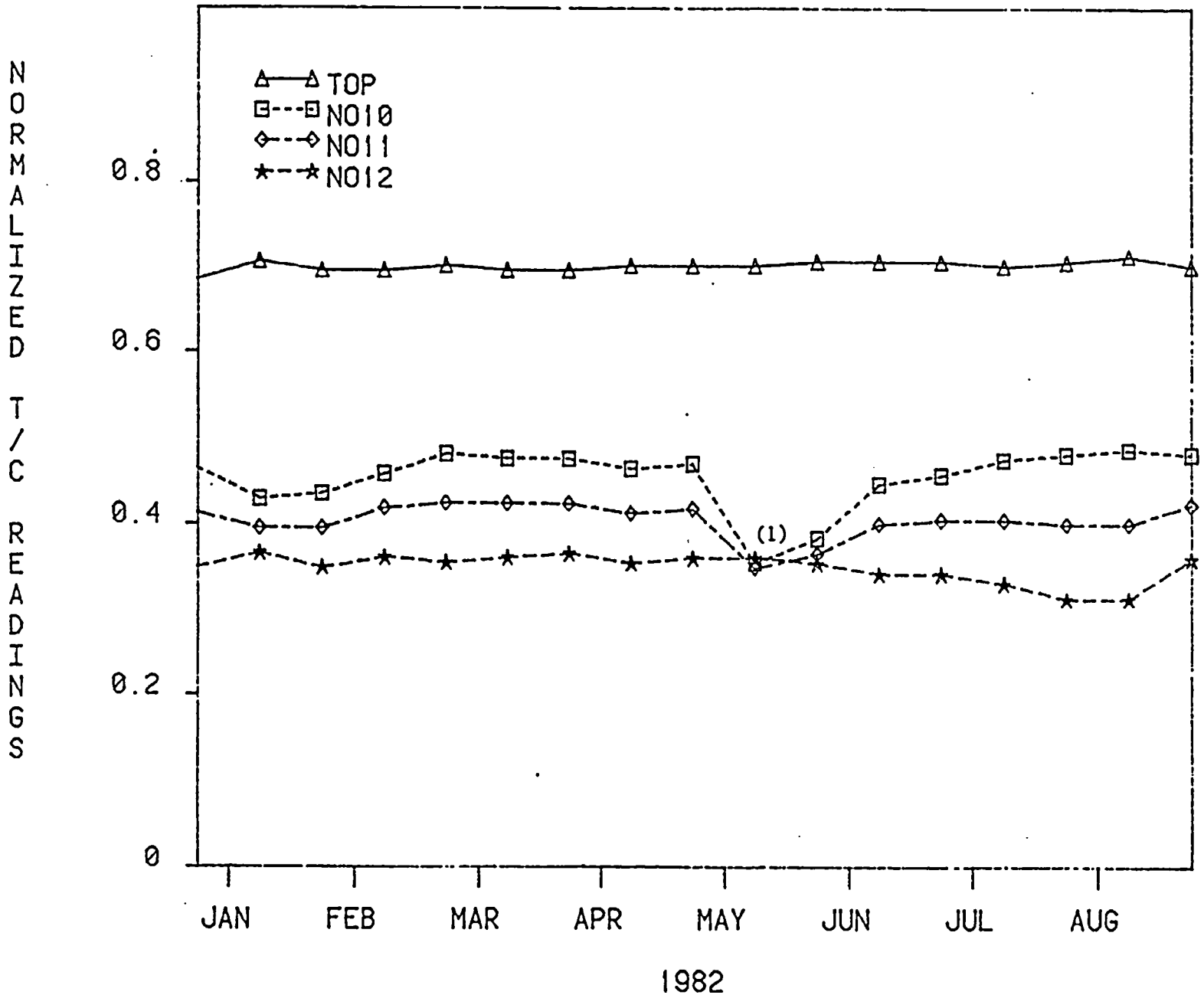
(1) Reactor scram on low level due to feedwater control system malfunction.

FEEDWATER NOZZLE TEMPERATURES
NOZZLE B



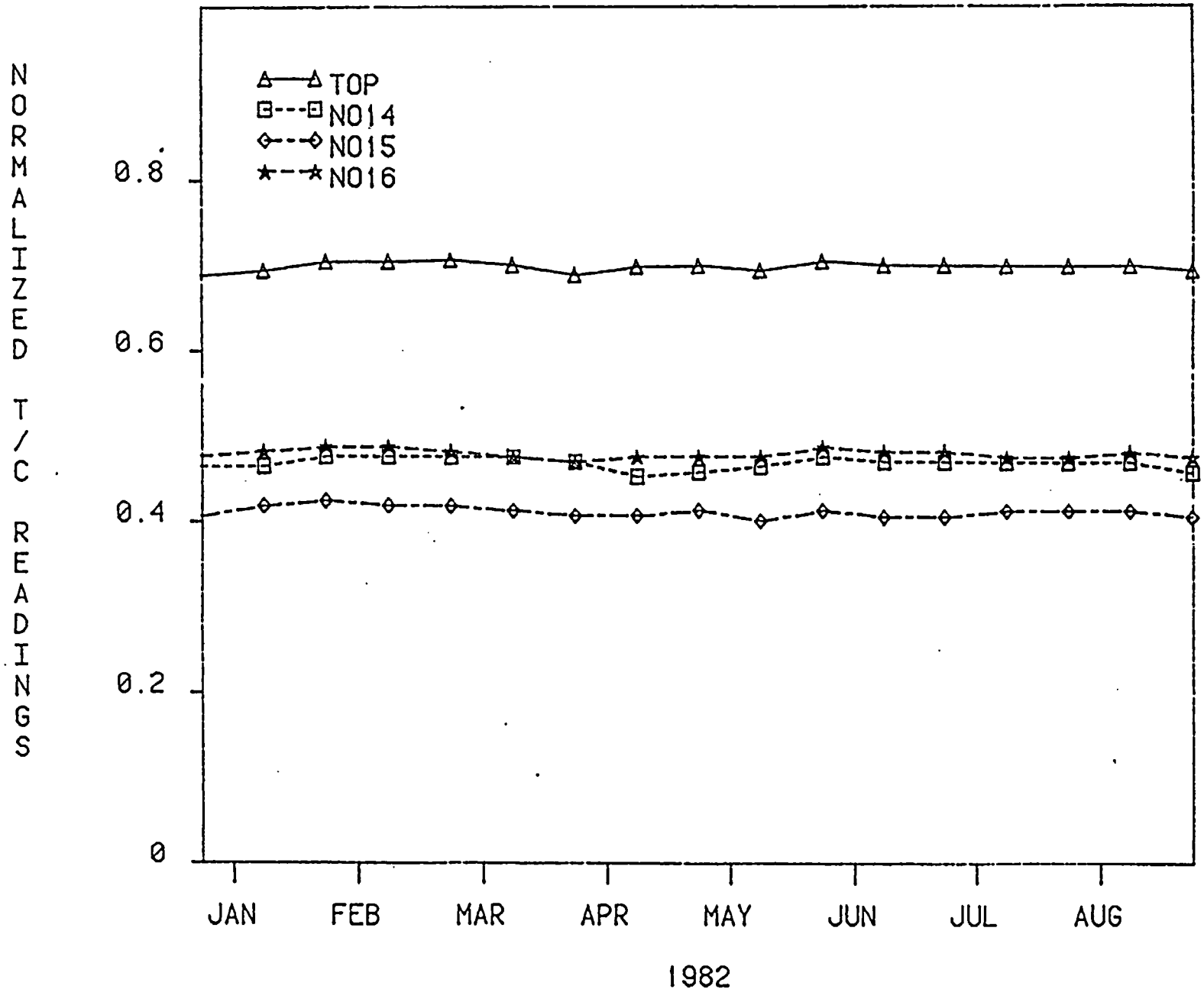
(1) Reactor scram on low level due to feedwater control system malfunction.
(2) N07 indication temporarily lost.

FEEDWATER NOZZLE TEMPERATURES
NOZZLE C



(1) Reactor scram on low level due to feedwater control system malfunction.

FEEDWATER NOZZLE TEMPERATURES
NOZZLE D



SUPPLEMENT 1
ATTACHMENT A

IMS DOCUMENT INPUT FORM - L

REQUIRED INFORMATION

2. PLANT VY 3. CLASSIFICATION TYPE L

4. RECORD TYPE NO. 02-C02-001

5. IMS SUBJECT NO. B03-01-01

6. DATE WRITTEN 820921

7. DOCUMENT FORM

8. DOCUMENT LOCATION

SUPPLEMENTAL INFORMATION

9. PRIMARY DOCUMENT NO. FV482-155

11. TITLE Feedwater Spargers - Response to NRC's Request for Additional INFO

12. KEYWORDS Feedwater; Sparger

13. ORIGINATOR

14. RECEIVER

17. REFERENCE DOCUMENT BV482-129; FV482-[illegible]060

21. WORK ORDER NO.

23. RESPONSE DUE DATE

ACTION* ADD/CHANGE/DELETE (CIRCLE ONE)

1. ACCESSION NUMBER

* If ADD, provide all document information and circle ADD.
If CHANGE, provide document Accession Number, corrected document characteristic information and circle CHANGE. If deleting all document information for a particular characteristic, write DELETE in appropriate entry.
If DELETE, provide document Accession Number and circle DELETE.

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