Docket File

August 19, 1983

Docket No. 50-271

Mr. J. B. Sinclair
Licensing Engineer
Vermont Yankee Nuclear Power
Corporation
1671 Worcester Road
Framingham, Massachusetts 01701

Dear Mr. Sinclair:

Re: Vermont Yankee Nuclear Power Station

The Commission has issued the enclosed Exemption from certain requirements of Section 50.54(o) and Appendix J to 10 CFR Part 50 for the Vermont Yankee Nuclear Power Station, in response to your letter dated September 9, 1975, as supplemented by letters dated September 19, 1980, January 21, 1981, October 27, 1981, and March 26, 1982, and telephone discussions with the staff on January 31, 1983, March 1 and 9, 1983, and April 26, 1983. This Exemption, which is being forwarded to the Office of the Federal Register for publication, pertains to the exclusion of the inboard feedwater check valves from the Type C test requirements, the exclusion of CRD insert and withdraw lines from the Appendix J test requirements, and permitting the testing of main steam isolation valves at a pressure of 24 psig.

Your request, however, to exempt the traversing incore probe (TIP) penetrations from testing has been denied. Furthermore, we have evaluated your request for exemptions related to certain other lines and valves meeting various specific requirements as described in the attached Safety Evaluation and have determined that no exemptions for these items are necessary.

The bases for our findings and the disposition of all of the exemption requests are contained in the enclosed Safety Evaluation.

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Within 60 days of the date of this letter please propose Technical Specifications reflecting the Appendix J testing requirements based on this exemption.

Sincerely,

Darrell G. Eisenhut
Division of Licensing
Office of Nuclear Reactor Regulation

Enclosures:
1. Exemption
2. Safety Evaluation

cc w/enclosures
See next page

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	Docket No. 50-271
	)	
VERMONT YANKEE NUCLEAR POWER CORPORATION	)	
	)	
(Vermont Yankee Nuclear Power Station)	)	

EXEMPTION

I.

The Vermont Yankee Nuclear Power Corporation (VYNPC/the licensee) is the holder of Facility Operating License No. DPR-28 (the license) which authorizes operation of the Vermont Yankee Nuclear Power Station, located in Windham County, Vermont, at steady state reactor core power levels not in excess of 1593 megawatts thermal (rated power). This license provides, among other things, that it is subject to all rules, regulations and Orders of the Commission now or hereafter in effect.

II.

Section 50.54(o) of 10 CFR Part 50 requires that primary reactor containments for water cooled power reactors be subject to the requirements of Appendix J to 10 CFR Part 50. Appendix J contains the leakage test requirements; schedules, and acceptance criteria for tests of the leak-tight integrity of the primary reactor containment and systems and components which penetrate the containment. Appendix J was published on February 14, 1973 and in August 1975, each licensee was requested to review the extent to which its facility met the requirements.

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On September 9, 1975, Vermont Yankee Nuclear Power Corporation submitted its evaluation of the Vermont Yankee Nuclear Power Station in which it assessed compliance with the rule and also requested an exemption from certain requirements of the rule. The VYNPC submittal for the Vermont Yankee Nuclear Power Station was supplemented by letters dated September 19, 1980, January 21, 1981, October 27, 1981, and March 26, 1982. In these submittals, VYNPC requested that certain test methodology, components, and penetrations be exempted from Appendix J requirements. The Franklin Research Center, as a consultant to NRR, has reviewed the licensee's submittals and prepared a Technical Evaluation Report (TER) of its findings. The NRC staff has reviewed this TER and in its Safety Evaluation Report dated July 2, 1982 the staff has concurred in the TER's bases and findings with the exception of Items 2 and 3 below, which required additional staff evaluation prior to determining the acceptability of the licensee's request.

The exemption requests found to be acceptable are as follows:

1. Section II.H.1 of Appendix J requires Type C testing of instrument lines that penetrate the containment and provide a direct connection between inside and outside containment atmosphere (such as atmospheric sample lines). Appendix J does not require local leak rate testing of isolation valves in other instrument lines because these lines are generally quite small and also because a line rupture of other passive failure must occur for a potential leakage path to exist. VYNPC requested exemption from Section II.H.1 for the CRD insert and withdraw lines. Although these are 1-inch lines, they are not, strictly speaking, instrument lines.

The integrity of the CRD insert and withdraw lines is provided by manual isolation valves capable of isolating the line in the event of a failure. Although the CRD insert and withdraw line valves are very difficult to test, the system is very unlikely to be a source of post-accident containment atmosphere leakage. This is because the CRD system is designed to reactor coolant pressure boundary criteria and continuously operates at reactor coolant pressure, which is orders of magnitude higher than post-accident containment pressure. Any system leakage would be identified during plant operation and subsequently repaired so that it can be relied upon to contain post-accident pressure should the need arise. For these reasons, the licensee's request for an exemption from the Type C testing requirements of Appendix J is acceptable.

2. Section II.H.4 of Appendix J requires in part, Type C testing of containment isolation valves in the feedwater system of a BWR. The feedwater system check valves provide this containment isolation function and therefore must be tested.

VYNPC replaced the outboard check valves in the feedwater lines with valves capable of meeting Appendix J test requirements. Based on experience in replacing the outboard check valves, anticipated personnel radiation exposure was predicted for inboard check valve replacement. The licensee condluded, and we agree, that anticipated radiation exposures associated with replacing the inboard check valves far exceed the benefits of replacing these valves.

Since the outboard valves have been replaced and will be tested in accordance with Appendix J, the need for qualified inboard valves is based on a consideration of possible single active failure to one of the outboard

valves. That is, in an accident, should one of the tested outboard check valves fail to shut, the corresponding inboard valve is relied upon to prevent the escape of containment air to atmosphere until the tested motor-operated isolation valves are shut.

The intent of Appendix J is to ensure that the escape of containment air to atmosphere following a design basis accident is maintained below established limits. The VYNPC proposal is considered technically adequate in achieving this intent for the following reasons:

1. The closing of a check valve is very reliable. The outboard valves will fail to close only if they are physically blocked by some foreign material or as a result of serious mechanical binding.
2. Even if the outboard valve fails to close, the inboard valve will remain water covered until all remaining feedwater has leaked through, providing a period of time to shut the motor-operated valves before there is any escape of containment atmosphere.
3. Even if the outboard valve fails to close, and the motor-operated valves are left open, system operating pressure greater than Pa can be maintained which will prevent leakage through the inboard valve out into the system.

In view of the above discussion and the predicted man-rem exposure submitted by VYNPC, the licensee's request for an exemption from the requirements of Appendix J is acceptable.

3. Section III.C.2 of Appendix J requires, in part, that Type C testing be performed at the peak calculated accident pressure (Pa). VYNPC requested an exemption from this requirement for the Main Steam Isolation Valves (MSIVs) to permit testing at 24 psig rather than at Pa (48 psig) and submitted certain design information as justification.

The MSIVs are leak tested by pressurizing between the valves. The MSIVs are angled in the main steam lines in the direction of flow in order to afford better sealing upon closure. A test pressure of Pa acting under the inboard disc is sufficient to lift the disc off its seats, and results in excessive leakage into the reactor vessel. This would result in a meaningless test. The proposed test calls for a test pressure of 24 psig to avoid lifting the disc at the inboard valve. The total observed leakage through both valves (inboard and outboard) is then conservatively assigned to the penetration. We conclude that testing at a reduced pressure of 24 psig is acceptable.

III.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, an exemption is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest. Therefore, the Commission hereby approves the following exemption requests:

1. Exemption is granted from the requirements of Section II.H.1 of Appendix J pertaining to the Type C testing of CRD insert and withdraw lines.

2. Exemption is granted from the requirements of Section II.H.1 of Appendix J pertaining to the Type C testing of the inboard feedwater check valves.

3. Exemption is granted from the requirements of Section III.C.2 of Appendix J pertaining to the Type C testing of the main steamline isolation valves at a test pressure of Pa. Testing at a reduced pressure of 24 psig is acceptable due to the unique design of the valves.

The NRC staff has determined that the granting of these exemptions will not result in any significant environmental impact and that pursuant to 10 CFR 51.5(d)(4), an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with this action.

For further details with respect to this action, see the Commission's related Safety Evaluation, which is available for public inspection at the Commission's Public Document Room, 1717 H Street, NW., Washington, D.C., and at the Brooks Memorial Library, 224 Main Street, Brattleboro, Vermont 05301.

FOR THE NUCLEAR REGULATORY COMMISSION

Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland
This 19th day of August 1983

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

APPENDIX J REVIEW

VERMONT YANKEE NUCLEAR POWER STATION

DOCKET NO. 50-271

1.0 Introduction

On August 5, 1975[1], the NRC requested Vermont Yankee Nuclear Power Corporation (licensee) to review its containment testing program for the Vermont Yankee Nuclear Power Station (Vermont Yankee), and the associated Technical Specifications, for compliance with the requirements of Appendix J to 10 CFR Part 50.

Appendix J to 10 CFR Part 50 was published on February 14, 1973. Since by this date there were already many operating nuclear plants and a number more in advance stages of design or construction, the NRC decided to have these plants reevaluated against the requirements of this new regulation. Therefore, beginning in 1975, requests for review of the extent of compliance with the requirements of Appendix J were made of each licensee. Following the initial responses to these requests, NRC staff positions were developed which would assure that the objectives of the testing requirements of the above cited regulation were satisfied. These staff positions have since been applied to our review of the submittals filed by the licensee for Vermont Yankee. The results of our evaluation are provided below.

2.0 Evaluation

Our consultant, the Franklin Research Center (FRC), has reviewed the licensee's submittals [2, 3, 4] and prepared an evaluation of containment leakage tests for Vermont Yankee. We have reviewed this evaluation and concur in its findings, with the exception of the need for a leakage collection system as a basis for testing the main steam isolation valves at 24 psig. Vermont Yankee does not have a leakage collection system, nevertheless, the assessment of valve leakage at 24 psig is acceptable. The design of the main steam isolation valves is such that testing in the reverse direction tends to unseat the valve. Testing of the two valves simultaneously, between the valves, at design pressure would lift the disc at the inboard valve. This would result in a meaningless test. The proposed test calls for a test pressure of 24 pounds per square inch gage to avoid lifting the disc at the inboard valve. The total observed leakage through both valves (inboard and outboard) is then conservatively assigned to the penetration. We conclude that this procedure is acceptable. In addition to concurring in our consultant's findings, we also concur with the bases contained in our consultant's evaluation,

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with the exception that we do not require testing the feedwater system motor operated valves as a bases for exempting the inboard feedwater system check valves from Appendix J testing. The Appendix J testing of the outboard feedwater check valves, the water seal on the inboard check valves, and the plant capability to maintain a pressure greater than Pa on the feedwater system provide the basis for this exemption.

3.0 Conclusion

Based on our review of the Technical Evaluation Report (TER) regarding the Appendix J review for Vermont Yankee, we conclude that:

3.1 Type C testing is not required and no exemption is necessary for the 1-in. diameter lines with at least one isolation valve and a cap in series, which is under administrative control or where plug-in test taps form the second barrier, which is also under administrative control.

3.2 Type C testing is not required and no exemption is necessary for lines forming a closed, seismic qualified loop totally within the reactor building, whose 30-days water supply is assured via the torus or reactor vessel and no single active failure can preclude the continous availablity of a water seal, because testing in this case is not required by Appendix J.

3.3 Type C testing is not required and no exemption is necessary for valves which remain open with the system operating at pressures greater than Pa throughout the 30-day post-accident period, considering possible single active failure, because Appendix J does not require this testing.

3.4 Type C testing is not required and no exemption is necessary for instrument lines of 1-in. or less that meet the provisions of Regulatory Guide 1.11 because Appendix J does not require this testing. TIP penetrations, however, do not fall into this category and should be tested, consequently the request to exempt TIP penetrations from testing should be denied.

3.5 Type C testing is not required and no exemption is necessary for instrument lines of 1-in or less forming a closed system within containment with no interface with containment atmosphere, with no automatic isolation, but remote manual isolation upon failure of a line, because Appendix J does not require this testing. CRD insert and withdraw lines, however, do not meet this description and an exemption under this category is not appropriate. Nevertheless, due to the design features of this system, an exemption from the testing requirements of Appendix J is acceptable and should be granted.

3.6 Type C testing is not required and no exemption is necessary for standby liquid control system lines equipped with normally closed valves, leak tight against reactor system pressure with explosive charges to open the valves under certain conditions, because Appendix J does not require this testing.

3.7 Appendix J permits testing of isolation valves in the direction opposite the direction of accident pressure, where the leakage is equivalent in either direction.

3.8 An exemption from the testing requirements of Appendix J for the inboard feedwater check valves should be authorized, based on the considerations described above. The licensee should ensure that emergency procedures are in effect to require closure of the motor-operated valves whenever containment isolation is required.

3.9 An exemption to permit testing of main steam isolation valves at 24 psig should be granted because it results in a meaningful test which does not lift the inboard valve disc.

4.0 References

1. NRC Generic Letter on Implementation of 10 CFR Part 50, Appendix J at Vermont Yankee, dated August 5, 1975.

2. VYC Letter to ONRR from Mr. J. French, dated September 9, 1975.

3. VYC letter from Mr. L. Marsolais to ONRR, dated September 19, 1980.

4. VYC letter from Mr. R. Smith to ONRR, dated January 21, 1981

5. VYC letter from E. W. Jackson to NRC dated October 27, 1981.

6. VYC letter from E. W. Jackson to NRC dated March 26, 1982.

Dated: August 19, 1983

Principal Contributor: J. Pulsipher

TECHNICAL EVALUATION REPORT

CONTAINMENT LEAKAGE RATE TESTING

(A-04)

VERMONT YANKEE NUCLEAR POWER CORPORATION
VERMONT YANKEE NUCLEAR POWER PLANT

NRC DOCKET NO. 50-271

NRC TAC NO. 08816

NRC CONTRACT NO. NRC-03-79-118

FRC PROJECT C5257

FRC ASSIGNMENT 1

FRC TASK 55

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Prepared for

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July 2, 1982

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FOREWORD

This Technical Evaluation Report was prepared by Franklin Research Center under a contract with the U.S. Nuclear Regulatory Commission (Office of Nuclear Reactor Regulation, Division of Operating Reactors) for technical assistance in support of NRC operating reactor licensing actions. The technical evaluation was conducted in accordance with criteria established by the NRC.

Mr. J. E. Kaucher and Mr. T. J. DelGaizo contributed to the technical preparation of this report through a subcontract with WESTEC Services, Inc.

1. BACKGROUND

On August 5, 1975 [1], the NRC requested that Vermont Yankee Nuclear Power Corporation (VYC) review the containment leakage testing program at Vermont Yankee Nuclear Plant and provide a plan for achieving full compliance with 10CFR50, Appendix J, Containment Leakage Testing, including appropriate design modifications, changes to technical specifications, and requests for exemption from the requirements pursuant to 10CFR50.12, where necessary.

VYC responded on September 9, 1975 [2], stating that the Vermont Yankee plant was in full compliance with the aspects of Appendix J relating to Type A and B tests, but that conflicts existed between Type C testing requirements and Vermont Yankee testing procedures. Accordingly, VYC requested exemption from the Type C testing requirements for certain containment isolation valves.

On January 29, 1980 [3], representatives of VYC met with Franklin Research Center and NRC staff personnel to discuss the status of VYC's exemption requests as well as certain other questions regarding containment leakage testing practices which had arisen as a result of NRC I&E field inspection reports in 1976 and 1977 [4, 5]. During this meeting, all questions were resolved except those relating to local leak testing of isolation valves. VYC agreed to review its containment isolation valve leak testing practices and propose a local leak rate test program that would address all aspects of the Appendix J requirements. The proposed program was subsequently submitted to the NRC on September 19, 1980 [6], and further revisions were submitted on January 21, 1981 [7].

The purpose of this report is to provide technical evaluations of all outstanding items related to the implementation of 10CFR50, Appendix J requirements at Vermont Yankee. Consequently, this report addresses the technical acceptability of the local leak rate testing program proposed in Reference 6 as modified by Reference 7.

2. EVALUATION CRITERIA

Code of Federal Regulations, Title 10, Part 50 (10CFR50), Appendix J, Containment Leakage Testing, was specified by the NRC as containing the criteria for the evaluations. Where applied to the following evaluations, the criteria are either referenced or briefly stated, where necessary, in support of the determinations or conclusions. Furthermore, in recognition of plant-specific conditions that could lead to requests for exemption not explicitly covered by the regulation, the NRC directed that the technical review constantly emphasize the intent of Appendix J, that potential containment atmospheric leakage paths be identified, monitored, and maintained below established limits.

3. TECHNICAL EVALUATION

The local leak test program proposed by VYC in Reference 6 lists all containment penetrations at the Vermont Yankee plant and indicates the testing required by Appendix J, testing proposed by VYC, and where there is a difference between the two, the type of exemption required. Reference 6 also describes the several types of proposed exemptions, the acceptance of which is essential to establishing the validity of the proposed program. Subsequent to the submittal of Reference 6, the Licensee provided Reference 7, which made slight modifications to Reference 6 and contained an additional exemption request regarding the testing of main steam isolation valves. The following technical evaluations are provided for each type of exemption proposed by VYC.

3.1 EXEMPTIONS FROM THE REQUIREMENTS OF APPENDIX J

3.1.1 Test Connections (Type 1 and 1A Exemptions)

Reference 6 describes Type 1 and 1A exemptions as follows:

"1. Line is 1" or less in diameter, is equipped with at least one valve and a cap in series, and is under administrative control.

1A. Plug in test tap forms second barrier, and is under administrative control."

Evaluation

Sections II.H and III.A.1.(d) of Appendix J provide the requirement for local leak rate testing of containment isolation valves which, because of the design of the systems or functions of the valves, are potentially exposed to the post-accident containment atmosphere. The purpose of performing local leak rate testing is twofold: First, local leak rate testing identifies specific valves that leak excessively so that maintenance can be performed on these valves; and second, local leak rate tests are performed approximately twice as often as the integrated containment leakage rate test (Type A test) so that any degradation of valve leakage integrity in the interim between Type A tests can be more readily detected.

The 1-in and smaller valves, caps, and test plugs referred to by VYC in these exemptions are installed to permit local testing. Appendix J does not explicitly direct testing of these components, probably because local testing is highly impractical, the lines are very small, and the caps and plugs are essentially reliable leakage barriers. In addition, these fittings are subjected to periodic Type A test pressure but, by their nature, do not require local testing to identify needed maintenance or potential degredation since the last Type A test. Consequently, it is concluded that these test fitting isolation valves, caps, and plugs need not be local leak rate tested because Appendix J does not require them to be Type C tested. No exemption from the requirements of Appendix J is needed.

3.1.2 Closed Systems Inside Containment (Type 2 Exemption)

Reference 6 describes Type 2 exemptions as follows:

> "2. Line forms a closed, seismic qualified loop totally within the reactor building, whose 30 day water supply is assured via the torus or reactor vessel. No single active failure can preclude the continuous availability of a water seal."

Evaluation

Sections II.H and III.A.1.(d) require Type C testing of containment isolation valves in systems with certain design features or characteristics. Section II.B, however, defines containment isolation valves as those valves relied upon to perform a containment isolation function. Section II.D defines leakage to be the escape of containment air to the outside atmosphere. Consequently, for the purpose of Appendix J, a containment isolation valve is one which is relied upon to prevent the escape of containment air to the outside atmosphere under post-accident conditions. Valves that are not relied upon to perform this function, even though they are a part of a system of Section III.A.1.(d) or have the characteristics of the valves of Section II.H, do not require Type C Testing in accordance with Appendix J.

Following an accident, lines that remain water-filled for at least 30 days with a water supply from the reactor vessel or the torus are effectively

water-sealed against potential air leakage throughout the post-accident period. VYC indicated that no possible single active failure can preclude the continuous availability of the water seal. Therefore, isolation valves in these lines are not relied upon to prevent the escape of containment air to outside atmosphere during the post-accident period because they are effectively water-sealed. Because Appendix J does not require that they be tested, no exemption from the requirements of Appendix J is needed.

3.1.3 Valves Remaining Open Post-Accident (Type 3 Exemption)

Reference 6 describes Type 3 exemptions as follows:

> "3. Valves in line will remain open with system operating pressure greater than Pa throughout the 30 day period, considering a possible single active failure."

Evaluation

Sections II.H and III.A.1.(d) require Type C testing of containment isolation valves in systems with certain design features or characteristics. Section II.B, however, defines containment isolation valves as those relied upon to perform a containment isolation function. Section II.D defines leakage to be the escape of containment air to the outside atmosphere. Consequently, for the purposes of Appendix J, a containment isolation valve is one which is relied upon to prevent the escape of containment air to the outside atmosphere under post-accident conditions. Valves that are not relied upon to perform this function, even though they are a part of a system of Section III.A.1.(d) or have the characteristics of the valves of Section II.H, do not require Type C testing in accordance with Appendix J.

If an isolation valve remains open in a system where operating pressure is greater than peak calculated accident pressure (Pa) throughout the 30-day post-accident period (despite the possibility of a single active failure in the system), then there is essentially no possibility of escape of containment air to the outside atmosphere during the post-accident period because of isolation valve leakage. Consequently, Type C testing of this valve is not required by Appendix J; therefore, no exemption is necessary.

3.1.4 Instrument Lines Penetrating Containment (Type 4 and 5 Exemptions)

Reference 6 describes Type 4 and 5 exemptions as follows:

"4. Line is an instrument line of 1" or less that meets the requirements of regulatory guide 1.11 which provides a suitable basis to implement General Design Criteria 55 and 56.

5. Line is an instrument line of 1" or less forming a closed system within the containment with no interface with containment atmosphere, has no auto isolation, but remote manual isolation upon failure of line."

Evaluation

Section II.H.1 of Appendix J requires Type C testing of instrument lines that penetrate the containment and provide a direct connection between inside and outside containment atmosphere (such as atmospheric sample lines). Appendix J does not require local leak rate testing of isolation valves in other instrument lines because these lines are generally quite small and also because a line rupture or other passive failure must occur for a potential leakage path to exist.

The integrity of the instrument lines described by VYC in Type 4 and 5 exemptions is furnished as a result of their having met the requirements of Regulatory Guide 1.11 or by providing manual isolation valves capable of isolating the line in the event of a failure. Consequently, these instrument lines do not require Type C testing in accordance with Appendix J and no exemption is needed. At the same time, many of these instrument lines are in systems which require venting and draining for the Type A test, so that test pressure will be exerted at the containment boundary. The Licensee should ensure that these instrument lines are exposed to Type A test pressure, wherever possible, particularly since the local leakage tests are not being performed.

It should be noted that in Reference 7, Type 4 exemptions are indicated from the traversing incore probe (TIP) penetrations. These penetrations are a unique type of sensing or instrument lines; as such, they do not conform completely to the requirements of Regulatory Guide 1.11 in that there is the

potential for considerable containment leakage through these lines. Further, one BWR licensee discovered that these penetrations can be tested without modification to the system by disconnecting TIP piping at the containment wall. This testing procedure is in effect at several BWR units. Consequently, these penetrations should not be exempted from Type C testing as a Type 4 exemption but should be tested in accordance with Appendix J.

With regard to the Type 5 exemption, VYC has applied this exemption to penetrations X-37 and X-38, the CRD insert and withdraw lines. Although these are 1-in lines, they are not, strictly speaking, instrument lines. Furthermore, they do not fit the description of closed systems as specified in Standard Review Plan 6.2.4, Containment Isolation; consequently, they are not considered in a closed system for the purposes of Appandix J. Therefore, exemption 5 does not provide an adequate technical basis for exemption of isolation valves in these lines.

Nevertheless, the CRD insert and withdraw lines have been regularly exempted from Type C testing requirements because the system isolation valves are very difficult to test and also because the system is very unlikely to be a source of post-accident containment atmosphere leakage. The CRD system is designed to reactor coolant pressure boundary criteria and continuously operates at reactor coolant pressure, which is orders of magnitude higher than post-accident containment pressure. Any system leakage would be identified during plant operation and subsequently repaired so that it can be relied upon to contain post-accident pressure should the need arise. For these reasons, an exemption from the Type C testing requirements of Appendix J should be granted.

3.1.5 Standby Liquid Control System Valves (Type 6 Exemption)

Reference 6 describes Type 6 exemptions as follows:

> "6. Line is equipped with normally closed valves, leaktight against reactor system pressure, explosive charge to open valve under certain accident conditions."

Evaluation

Type 6 exemptions are applicable to the standby-liquid control system. This system is designed to inject a liquid poison into the core if the control rod system is unable to insert enough negative reactivity to shut down the reactor. Because the system is never expected to be used and because of the desire to prevent inadvertent leakage of the liquid poison into the reactor vessel (e.g., when running the pumps for test), the system was provided with specially designed valves that require firing an explosive squib which causes a plunger to physically rupture the valve seal. Consequently, these valves do not have typical seat-and-disc sealing characteristics but actually provide a solid, leaktight flow barrier that must be ruptured before flow or leakage exists. Because of the special sealing feature of these valves, the containment isolation valves in the standby liquid control system injection line are not relied upon to prevent the escape of containment air to the outside atmosphere.

Section III.A.1.(d) of Appendix J requires that containment isolation valves in systems which connect to the reactor coolant system and penetrate the boundary of the containment be local leak rate tested in accordance with Type C testing procedures. Section II.B, however, defines containment isolation valves as those relied upon to perform a containment isolation function. Section II.D defines leakage as the escape of containment air to the outside atmosphere. Consequently, valves that are not relied upon to prevent the escape of containment air to the outside atmosphere in a post-accident condition do not require testing in accordance with Appendix J.

In view of the foregoing discussion, the isolation valves in the standby-liquid control system containment penetration do not require testing in accordance with Appendix J and no exemption from the regulation requirements is necessary.

3.1.6 Reverse Direction Testing (Type 7 Exemption)

Reference 6 describes Type 7 exemptions as follows:

"7. Valve tested in reverse direction. Previous contact with manufacturer indicates equivalent leakage in either direction."

Evaluation

Section III.C.1 of Appendix J permits Type C testing of containment isolation valves in a direction different than that in which the valves would be required to perform their safety function when it can be determined that the results are equivalent or more conservative. VYC stated that the manufacturer of the valves for which Type 7 exemptions are requested indicated that equivalent test measurements will result in either the direction of accident pressure or the reverse direction. Consequently, reverse direction testing of these valves is acceptable and no exemption from Appendix J is required.

3.1.7 Feedwater System Check Valves (Type 8 Exemption)

In Reference 6, VYC described the Type 8 exemption regarding feedwater system penetrations X-9A and X-9B as follows:

> "8. Feedwater System, Penetration X-9A and X-9B
>
> Currently installed check valves were not designed to, nor can they meet current Appendix J test requirements. New valves will be ordered and installed which will meet both feedwater system and Appendix J test requirements. During the interim period, existing motor operated valves in the feedwater system will be designated, in this content, as containment isolation valves and will be leak tested to containment isolation criteria."

In Reference 8, however, VYC reported to the NRC that it was in a position to install one outboard check valve in each feedwater line during an upcoming outage. VYC further stated its intention to conduct a formal ALARA analysis during the outage to determine the desirability of installing the inboard check valves. VYC stated that during the interim period, existing motor-operated valves in the feedwater system would continue to be designated as containment isolation valves and leak-tested to containment isolation criteria.

In Reference 9, VYC reported that the outboard check valve in each feedwater line had been replaced. VYC stated that the results of the ALARA analysis revealed that the radiation exposures associated with replacing the

inboard check valves far exceeded the benefits of replacing these valves. VYC's intention was to retain the request for exemption for the inboard check valves. VYC's conclusion to Reference is quoted below:

> "It is Vermont Yankee's judgement that because of the major improvements already gained in the leakage integrity of the feedwater lines, the potential consequences to the health and safety of the public are sufficiently reduced such that replacement of the inboard check valves is not warranted. The ALARA analysis reveals the exposure range to be between 484 and 715 man-rems. The total man-rem exposure for the fourth quarter of 1981, which encompasses the refueling outage, was 541 man-rems. Therefore, the primary containment portion of the feedwater check valves replacement represents from 89% to well over 100% of the radiation exposure absorbed by workers during an outage of average duration and work load such as the 1981 refueling outage. We feel the benefits of replacing the existing inboard feedwater check valves do not outweight the risks associated with the high radiation exposure.
>
> It is also, therefore, out intention to retain the present exemption to the Type C Leak Rate Test Program for the inboard check valves (Reference (b)), and place the new outboard check valves on the schedule for Leak Testing per Appendix J. The Technical Specifications will be revised as necessary pending your formal review of our Reference (b) including the subsequent revisions."

Evaluation

Section II.H.4 of Appendix J requires Type C testing of containment isolation valves in the feedwater system of a BWR. The feedwater system check valves were installed to provide this containment isolation function and therefore must be tested. VYC recognized the importance of testing the feedwater check valves for compliance with Appendix J and agreed to replace the originally installed valves with valves capable of meeting Appendix J requirements. VYC proposed to designate existing motor-operated valves in the feedwater system as containment isolation valves and to test these valves in accordance with Appendix J as an interim measure until replacement of the check could be accomplished.

Subsequently, VYC discovered that replacing the check valves resulted in significant radiation exposure to maintenance personnel. VYC's predicted exposure for the replacement of the inboard check valves is provided below:

"Predicted Exposure for the Replacement of the Inboard Feedwater Check Valves

Task	Man-hours	Man-rems	Notes
Removing and reinstalling insulation	236	18.9	1
Removing and reinstalling adjacent obstacles	88	7.0	1
Rigging necessary to remove and install the check valves	357	28.6	1
Cutting and removal of the old check valves, and the prep, fit up, and welding of the new check valves	5086	406.9	1
Health Physics coverage and other supervision	288	23.0	3
Sub-Total	6055	484.4	
Contingency	2883	230.6	
Total	8938	715.0	2

Note 1 - The man-hour predicitions are based on actual work performed on the outboard feedwater check valves multiplied by 0.080 R/hr to get the man-rem predictions.

Note 2 - We feel the exposure analysis is low since it is based on actual work performed outside of the primary containment. Our experience has shown that to perform a similar task inside the containment takes considerably more man-hours. A contingency of 50% of the total man-hours from Note 1 tasks is utilized for this case.

Note 3 - This item is an estimate because it was not part of the scope of the outboard check valve replacement."

VYC indicated that the use of temporary shielding to reduce the exposures from the Note 1 tasks had been considered but was ineffective because of the high general area dose rates which would cause more exposure while installing the shielding than would be saved during the valve work.

Since the outboard valves have been replaced and will be tested in accordance with Appendix J, the need for qualified inboard valves is based on a consideration of possible single active failure to one of the outboard valves. That is, in an accident, should one of the tested outboard check

valves fail to shut, the corresponding inboard valve is relied upon to prevent the escape of containment air to atmosphere until the tested motor-operated isolation valves are shut.

The intent of Appendix J is to ensure that the escape of containment air to atmosphere following a design basis accident is maintained below established limits. The VYC proposal is considered technically adequate in achieving this intent for the following reasons:

1. The closing of a check valve is very reliable. The outboard valves will fail to close only if they are physically blocked by some foreign material or as result of serious mechanical binding.

2. Even if the outboard valve fails to close, the inboard valve will remain water covered until all remaining feedwater has leaked through, providing a period of time to shut the motor-operated valves before there is any escape of containment atmosphere.

3. The motor-operated valves are tested in accordance with Appendix J; once they are shut, therefore, the requirments of Appendix J have been complied with even in the case of a single failure to an outbaord check valve.

In view of the above discussion and the predicted man-rem exposure submitted by VYC, an exemption from the requirements of Appendix J should be approved because the intent of Appendix J will be met. The Licensee should ensure that emergency procedures are in effect requiring closure of the tested motor-operated valves whenever containment isolation is required.

3.1.8 Main Steam Isolation Valves

In Reference 7, VYC requested permission to test the main steam isolation valves (2-83A,B,C,D) at a reduced pressure of 24 psig. The Licensee stated that it would use a 11.5 SCFH leakage rate maximum as the criteria by which to evaluate acceptable leaktightness.

Evaluation

Section III.C.2 of Appendix J requires that containment isolation valves be local leak rate tested at a pressure of Pa. The design of the main steam system in most operating BWR plants, however, makes this an unrealistic requirement.

The design of the main steam system in most operating BWR plants necessitates leak testing of the main steam isolation valves (MSIVs) by pressurizing between the inboard and outboard valves. The MSIVs are angled in the main steam lines to afford better sealing in the direction of accident leakage. Because of this design, a test pressure of Pa acting on the inboard disc tends to lift the disc off the seat, resulting in excessive leakage into the reactor vessel. The NRC staff considered this matter and determined that testing at pressures of approximately 1/2 Pa would result in a conservative measure of leaktightness. VYC has requested permission to test these valves to 24 psig, while Pa has been stated to be 44 psig.

Since testing of the MSIVs (24 psig) gives rise to a greater leakage than Pa applied upstream of the valves, the testing procedure results in a conservative determination of the leakage rate through the valves. Consequently, VYC's proposal to test MSIVs at a pressure of 24 psig by pressurizing between the valves is an acceptable exemption to the requirements of Section III.C.2.

At the same time, the Licensee states that 11.5 scfh will be used as the leakage rate criteria for acceptance of these tests. This is generally acceptable because most BWRs have a leakage collection system associated with the MSIVs which dispose of leakage through controlled means. Assuming that VYC has such a system, these criteria are also technically sufficient in meeting the objective of Appendix J and an exemption from the requirements of Appendix J should be granted.

4. CONCLUSIONS

The revised containment leakage testing program submitted by VYC in References 6 and 7 was evaluated. The conclusions are as follows:

- Type C testing is not required and no exemption is necessary for 1-in diameter lines with at least one isolation valve and a cap in series, which is under administrative control or where plug-in test taps form the second barrier, which is also under administrative control.

- Type C testing is not required and no exemption is necessary for lines forming a closed, seismic qualified loop totally within the reactor building, whose 30-day water supply is assured via the torus or reactor vessel and no single active failure can preclude the continuous availability of a water seal, because testing in this case is not required by Appendix J.

- Type C testing is not required and no exemption is necessary for valves which remain open with the system operating at pressures greater than Pa throughout the 30-day post-accident period, considering possible single active failure, because Appendix J does not require this testing.

- Type C testing is not required and no exemption is necessary for instrument lines of 1-in or less that meet the requirements of Regulatory Guide 1.11 because Appendix J does not require this testing. TIP penetrations, however, do not fall into this category and should be tested.

- Type C testing is not required and no exemption is necessary for instrument lines of 1-in or less forming a closed system within containment with no interface with containment atmosphere, with no auto isolation, but remote manual isolation upon failure of a line, because Appendix J does not require this testing. CRD insert and withdraw lines, however, do not meet this description and an exemption under this category is not appropriate. Nevertheless, due to the design features of the CRD system, an exemption from Type C testing is justified on other bases and should be granted.

- Type C testing is not required and no exemption is necessary for lines equipped with normally closed valves, leak tight against reactor system pressure with explosive charges to open the valves under certain conditions, because Appendix J does not require this testing.

- Appendix J permits testing of isolation valves in the direction opposite the direction of accident pressure, where the leakage is equivalent in either direction.

- A proposal to designate motor-operated isolation valves in the feedwater system as containment isolation valves in lieu of the inboard feedwater system check valves satisfies the intent of Appendix J. An exemption from the requirements of Appendix J for the inboard feedwater check valves should be authorized. The Licensee should ensure that emergency procedures are in effect to require closure of the motor-operated valves whenever containment isolation is required.

- An exemption to permit testing of main steam isolation valves at 24 psig should be granted because it results in a conservative assessment of valve leakage. An acceptance criteria of 11.5 scfh per valve is satisfactory where a leakage collection system is available.

5. REFERENCES

1. NRC
   Generic Letter to VYC
   Subject: Implementation of 10CFR50, Appendix J
   August 5, 1975

2. J. L. French, VYC
   Letter to Office of Nuclear Reactor Regulation
   September 9, 1975

3. S. P. Carfagno, FRC
   Letter to G. Zech, NRC
   Subject: Notes of Meeting with Vermont Yankee on January 29, 1980
   January 31 1980

4. E. C. McCabe Jr., NRC
   Letter to Mr. K. V. Seyfrit, NRC/IE
   Subject: NRC Region I Inspection of August 30, 1976
   September 15, 1976

5. Mr. E. J. Brunner, NRC
   Letter to Mr. R. H. Groce, VYC
   Subject: NRC Inspection of September 13-15, 1977
   September 29, 1977

6. L. D. Marsolais, VYC
   Letter to Office of Nuclear Reactor Regulation
   September 19, 1980

7. R. L. Smith, VYC
   Letter to Office of Nuclear Reactor Regulation
   January 21, 1981

8. VYC letter from E. W. Jackson to NRC, dated October 27, 1981.

9. VYC letter from E. W. Jackson to NRC, dated March 26, 1982.