TECHNICAL EVALUATION REPORT

CONTAINMENT LEAKAGE RATE TESTING

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT UNITS 1, 2, AND 3

NRC DOCKET NO. 50-259/260/296

NRC TAC NO. 08715/08716/08717

NRC CONTRACT NO. NRC-03-79-118

FRC PROJECT C5257

FRC ASSIGNMENT 1

FRC TASKS 5/6/176

Prepared by

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Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

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December 23, 1981

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1. BACKGROUND

On August 4, 1975 [1], the NRC requested the Tennessee Valley Authority (TVA) to review the containment leakage testing programs at Browns Ferry Nuclear Plant and to provide a plan for achieving full compliance with 10CFR50, Appendix J, including appropriate design modifications, changes to technical specifications, or requests for exemption from the requirements pursuant to 10CFR50.12, where necessary.

TVA responded to the NRC's request in a series of four letters dated September 9, 1975 [2], October 10, 1975 [3], January 15, 1976 [4], and February 26, 1976 [5]. As result of this correspondence, TVA requested certain exemptions from the requirements of Appendix J. The NRC responded in a letter dated December 27, 1976 [6], requesting clarification of certain areas.

On July 8, 1977 [7], TVA provided the additional information and also requested another exemption which had not been previously indicated. On May 27, 1980 [8], TVA provided still further information in response to another NRC request for information dated April 21, 1980 [9].

The purpose of this report is to provide technical evaluations of outstanding submittals regarding the implementation of the requirements of 10CFR50, Appendix J, at Browns Ferry Nuclear Plant Units 1, 2, and 3. Consequently, technical evaluations of the requests for exemption and one item of clarification of the requirements, as submitted in the above correspondence, are provided.

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 regulations, 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

3.1 REQUESTS FOR EXEMPTION FROM THE REQUIREMENTS OF APPENDIX J

Reference 5 superseded the partial responses to the NRC's generic letter, which had been submitted by TVA in References 2, 3, and 4. In Reference 5, TVA requested exemptions from the requirements of Appendix J in eight categories. The current status of these requests for exemption, as modified by subsequent correspondence, is provided below:

Exemption Request	Status
1. Venting of the containment inerting system during Type A testing.	Exemption withdrawn by Reference 7. System to be modified to permit venting.
2. Venting of the containment air dilution system during Type A testing.	Exemption withdrawn by Reference 7. System to be modified to permit venting.
3. Draining and venting of instrument sensing lines during Type A testing.	Temporary exemption requested while excess flow check valves are installed.
4. Draining and venting of the seal water supply of the reactor recirculation pumps during Type A testing.	Temporary exemption requested while test connections are installed.
5. Type B testing of containment airlocks.	Permanent exemption requested from the frequency of the Pa (peak calculated accident pressure) test.
6. Reverse direction Type C testing of certain isolation valves.	Permanent exemption requested for three valves.
7. Reduced pressure Type C testing of main steam isolation valves.	Permanent exemption requested to test at 25 psig rather than Pa.
8. Type C testing with water in lieu of air or nitrogen as a medium.	Exemption request for certain valves withdrawn in Reference 8. These valves are now tested with air.

Since the exemption requests for Items 1 and 2 have been completely withdrawn, these items were not evaluated. Technical evaluations of the remaining six items are presented below, along with the additional exemptions requested in Reference 7.

3.1.1 Draining and Venting of Instrument Sensing Lines During Type A Testing

In Reference 5, TVA requested an exemption from Section III.A.1.(d) for instrument sensing lines which are not drained and vent during the Type A test. TVA stated:

> "In order to maintain adequate indication and control for safe operation of the unit, instrument sensing lines are not drained and vented inboard and outboard of the excess flow check valve. The instrument system, outboard of primary containment, is a closed, qualified system. However, excess flow check valves are functionally tested once each operating cycle to ensure their integrity. A permanent exemption from Appendix J venting and draining requirements is requested for this item."

In Reference 7, TVA further stated:

> "In regard to the proposed exemption for instrument sensing lines (item 3 of the February 26 letter), we continue to request a permanent exemption from paragraph III.A.1(d) with regard to venting and draining these lines during the type A test. A detailed evaluation which demonstrates that Browns Ferry units 1, 2, and 3 are in accordance with the provisions of Regulatory Guide 1.11 for instrument lines that are part of a protection system and connected to the primary reactor coolant system is discussed in our response to AEC question 5.15 dated March 25, 1971. An additional 17 instrument lines, which were not addressed in this response because they are not part of this protection system, do not meet the requirements of Regulatory Guide 1.11. These instrument lines are identified in the following Table 2.1.2. Excessive flow check valves will be installed in these lines, and temporary exemption to the requirements of Regulatory Guide 1.11 is requested until their installation."

Evaluation

Regulatory Guide 1.11, Instrument Lines Penetrating Primary Reactor Containment, provides a basis for implementing General Design Criteria 55 and 56 regarding the isolation of instrument lines penetrating the containment.

This guide permits the use of self-actuated excess flow check valves to isolate these lines as a compromise between the competing functions of maintaining the operability of the instrument and preventing containment outleakage. However, the guide does not consider the closed system outside containment sufficiently rupture-proof to rely on it to prevent containment leakage. The guide states: "The probability of such a rupture [a component in an instrument line outside containment] is considered to be sufficiently high that the calculated offsite exposures that might result from such a single failure during normal operation should be substantially below the guidelines of 10CFR100." Therefore, leakage testing in accordance with Appendix J should be conducted.

Section III.A.1.(d) of Appendix J does not require the venting and draining during Type A testing of systems that are required to maintain the plant in a safe condition during the test. According to the TVA submittal, the instrument lines are in this category. At the same time, however, Section III.A.1.(d) requires Type C testing of containment isolation valves which are not drained and vented during the Type A test. Consequently, no exemption from the requirements of Appendix J is required provided that a Type C leakage test is performed together with the periodic functionality test of the excess flow check valves or at other convenient intervals as required by Appendix J. Results from these local leakage rate tests should be used to back-correct the Type A test results to ensure that the integrated containment leakage rate is within specification.

3.1.2 Draining and Venting of the Seal Water Supply to the Reactor Recirculation Pumps During Type A Testing

In Reference 5, TVA requested a permanent exemption from the requirements of Appendix J to exclude the seal water supply to the reactor recirculation pumps from the draining and venting requirements of Appendix J. TVA stated that this seal water supply could not be vented downstream of the inboard isolation valves. In Reference 7, TVA stated that this request applied to the 3/4-inch supply line from the control rod drive (CRD) hydraulic control and that test connections would be installed to perform the required draining and venting. In Reference 7, TVA requested that a temporary exemption be granted in lieu of the original request for permanent exemption while the modification is being installed.

Evaluation

TVA is committed to modifying these lines to permit compliance with the requirements of Appendix J in future Type A tests. Since the line involved is a 3/4-inch line which cannot be vented without the modification, FRC finds a temporary exemption to be acceptable.

3.1.3 Type B Testing of Containment Airlocks

In Reference 5, TVA requested an exemption from the requirements of Appendix J to permit continued testing of containment airlocks at the Browns Ferry plant at 2.5 psig within a short time after each opening and at no less than Pa once each operating cycle.

In Reference 7, TVA stated that it would modify its technical specifications to require the reduced pressure test within 3 days of the first of each series of openings whenever containment integrity is required, but reiterated its request for a permanent exemption from Appendix J to require the Pa test once each operating cycle rather than every 6 months.

TVA's basis for this request is that, to conduct the Pa test, the unit must be in cold shutdown and the containment deinerted for entry into the containment to install the holding devices needed to keep the inner door from unseating. Because of excessive radiation exposure to maintenance and test personnel during the installation of the holding devices and test performance, these employees cannot remain inside containment. In order to provide an exit and entrance during this test, containment integrity is broken by providing access through the CRD hatch. In addition, TVA's experience has shown that the inner door acts as a variable orifice when tests at Pa are conducted, and high leakage rates into containment are observed through the inner door seals. Since there is no detectable leakage through the inner door seals during pressurization from the proper direction (i.e., during the Type A test), TVA concludes that tests conducted at Pa are ultraconservative and of little value in determining overall leakage from containment via the airlock assembly. Experience has also shown that reduced pressure tests, without holding clamps, will not only demonstrate that the door seals are intact, but will also demonstrate that the entire airlock assembly is intact.

TVA reiterated its belief that the 6-month test at Pa adds an unnecessary burden leading to increased manpower requirements, personnel exposure, and loss of revenue and only results in unrealistic leakage rates. TVA continued to request a permanent exemption to paragraph III.D.2 of Appendix J. TVA indicated that it would develop procedures to determine a method of conservatively extrapolating the leakage obtained during reduced pressure tests to the leakage rate that would be experienced under accident conditions. To verify that there is no deterioration of the airlock assembly, TVA also proposed to conduct reduced pressure tests within 6 months of the first of each series of openings whenever containment integrity is required.

Evaluation

Sections III.B.2 and III.D.2 of Appendix J require that containment airlocks be tested at Pa at 6-month intervals and after each opening in the interim between 6-month tests. These requirements were imposed because airlocks represent potentially large leakage paths which are more subject to human error than other containment penetrations. Type B penetrations (other than airlocks) require testing in accordance with Appendix J at intervals not to exceed 2 years.

Appendix J was published in 1973. A compilation of airlock events from Licensee Event Reports submitted since 1969 shows that airlock testing in accordance with Appendix J has been effective in the prompt identification of airlock leakage, but that rigid adherence to the after-each-opening requirement may not be necessary.

Since 1969, there have been approximately 70 reported airlock leakage tests in which measured leakage exceeded allowable limits. Of these events, 25% were the result of leakage other than from improper seating of airlock door seals. These failures were generally caused by leakage past door operating mechanism handwheel packing, door operating cylinder shaft seals, equalizer valves, or test lines. These penetrations resemble other Type B or C containment penetrations except that they may be operated more frequently. Since airlocks are tested at a pressure of Pa every 6 months, these penetrations are tested, at a minimum, four times more frequently than typical Type B or C penetrations. The 6-month test is, therefore, considered to be both justified and adequate for the prompt identification of this leakage.

Improper seating of the airlock door seals, however, is not only the most frequent cause of airlock failures (the remaining 75%), but also represents a potentially large leakage path. While testing at a pressure of Pa after each opening will identify seal leakage, it can also be identified by alternative methods such as pressurizing between double-gasketed door seals (for airlocks designed with this type of seal) or pressurizing the airlock to pressures other than Pa. Furthermore, experience gained in testing airlocks since the issuance of Appendix J indicates that the use of one of these alternative methods may be preferable to the full-pressure test of the entire airlock.

Reactor plants designed prior to the issuance of Appendix J often do not have the capability to test airlocks at Pa without the installation of strongbacks or the performance of mechanical adjustments to the operating mechanisms of the inner doors. The reason for this is that the inner doors are designed to seat with accident pressure on the containment side of the door, and therefore, the operating mechanisms were not designed to withstand accident pressure in the opposite direction. When the airlock is pressurized for a local airlock test (i.e., pressurized between the doors), pressure is exerted on the airlock side of the inner door, causing the door to unseat and preventing the performance of a meaningful test. The strongback or mechanical adjustments prevent the unseating of the inner door, allowing the test to proceed. The installation of strongbacks or performance of mechanical adjustments is time consuming (often taking several hours), may result in additional radiation exposure to operating personnel, and may also cause degradation of the operating mechanism of the inner door, with consequential loss of reliability of the airlock. In addition, when conditions require frequent openings over a short period of time, testing at Pa after each opening becomes both impractical (tests often take from 8 hours to several days) and accelerates the rate of exposure of personnel and the degradation of mechanical equipment.

For these reasons, FRC concludes that the intent of Appendix J is satisfied, and the undesirable effects of testing after each opening are reduced, if a satisfactory test of the airlock door seals is performed within 3 days of each opening or every 3 days during periods of frequent openings, whenever containment integrity is required. The test of the airlock door seals may be performed by pressurizing the space between the double-gasketed seals (if so equipped) or by pressurizing the entire airlock to a pressure less than Pa that does not require the installation of strongbacks or performance of other mechanical adjustments. If the reduced pressure airlock test is to be employed, the results of the leakage test must be conservatively extrapolated to equivalent Pa test results.

TVA maintains that airlock testing at Pa every 6 months adds an unnecessary burden leading to increased manpower requirements, personnel exposure, and loss of revenue to obtain unrealistic leakage rate results. FRC does not believe that TVA characterizes the airlock test results at Pa as unrealistic when the holding devices are in place but rather when the holding devices are not used. With the holding devices in place, the entire airlock assembly is tested at Pa (simulating accident conditions), except for the gasket of the inner door which is conservatively tested since the actual gasket seating force (Pa pressure within the containment) is much larger than the seating force maintained by the holding devices resisting the internal airlock test pressure. If the holding devices are not capable of sealing the inner door during the Pa test, this is a problem which has not been identified by other BWR licensees. Consequently, FRC finds that a Pa air test every 6 months is essential to ensure the integrity of the entire airlock assembly and that TVA's request to test airlocks at Pa once each operating cycle is unacceptable.

FRC concurs with TVA, however, that when 6 months has passed since the last successful airlock test at Pa and there have been no airlock entries in the interim, there is inadequate justification for shutting down the unit and deinerting the containment to perform an airlock test at Pa. In fact, when the airlock has not been opened since the last successful Pa test, the reasons for testing airlocks more frequently than other Type B penetrations (e.g., more frequent use, more prone to human error) are inapplicable. Consequently, FRC finds that the interval between 6-month tests may be extended up to one year, provided that there have been no operations of the airlock since the last successful Pa test and provided that a Pa test is performed following the next airlock entry.

In conclusion, FRC finds TVA's proposal to test containment airlocks once each operating cycle at a pressure of Pa and every 6 months at a pressure of 2.5 psig to be unacceptable. FRC finds that containment airlocks must be tested at 6-month intervals at a pressure of Pa in accordance with Appendix J, except that this testing interval may be extended if there have been no airlock operations since the last sucessful Pa air test and if a Pa test is performed following the next airlock opening. FRC finds that testing in accordance with these requirements is acceptable in meeting the intent and objective of Appendix J.

FRC further finds that TVA's proposed exemption from Appendix J to test airlocks at 2.5 psig rather than at Pa after each opening is acceptable if the test is accomplished within 72 hours of each opening or every 72 hours during periods of frequent openings, and if the test results are conservatively extrapolated to the Pa test results. For the Licensee's information, the following correlation has been found to be conservative in extrapolating the mass flow rate at pressure Pt ($\dot{m}t$) to the mass flow rate at pressure Pa ($\dot{m}a$) (assuming constant temperature; Pat = atmospheric pressure):

$$\frac{\dot{m}a}{\dot{m}t} = \frac{(Pa + Pat)^2 - (Pat)^2}{(Pt + Pat)^2 - (Pat)^2}$$

The above airlock requirements should be in effect whenever containment integrity is required.

3.1.4 Reverse Direction Type C Testing of Certain Isolation Valves

In Reference 5, TVA identified 27 valves for which test pressure could not be applied in the direction that the valves would be required to perform their safety function. TVA stated that these valves could be tested by local pressurization in the opposite direction and, with few exceptions, that they were also subjected to Type A differential test pressure.

In Reference 7, TVA indicated that the response of Reference 5 did not consider valve type, only pressure direction. A further review revealed that only 3 of the 27 valves originally identified were not water sealed to prevent the escape of containment air, were pressurized for testing from the opposite direction, and had leakage rates that could not be conservatively established when pressurized from the opposite direction. These valves are single-wedge gate valves which, because of plant design, cannot be pressurized in the direction in which they perform their safety function. TVA requested a permanent exemption from the requirements of Appendix J to permit continued reverse direction testing of these three valves.

Evaluation

Section III.C.1 of Appendix J permits Type C testing of containment isolation valves in a direction other than that in which the valves perform their safety function, if it can be shown that the results of testing are equivalent to or more conservative than results of testing in the direction of the safety function. For valves which are relied upon to perform a containment isolation function during post-accident conditions, there does not appear to be a satisfactory justification for an exemption from these requirements when a showing of equivalent or more conservative results is not possible.

In the case of valves FCV 1-55, FCV 71-2, and FCV 73-2, TVA has stated that they are not water sealed to prevent the escape of containment air. Further, they are single wedge gate valves which are not capable of meeting the equivalent or more conservative test of Section III.C.1. The fact that plant design does not currently permit testing in the direction of accident pressure is not, in itself, sufficient justification for an exemption from the requirements and intent of Appendix J. Consequently, valves FCV 1-55, FCV 71-2, and FCV 73-2, should be tested in the direction of their safety function. An exemption in this case is not acceptable.

3.1.5 Reduced Pressure Type C Testing of Main Steam Isolation Valves (MSIVs)

In Reference 5, TVA requested exemption from the requirements of Appendix J to permit continued testing of MSIVs at 25 psig rather than Pa. TVA stated that the design of the Browns Ferry MSIVs makes it impossible to conduct leak rate tests at Pa since Pa must be applied in the wrong direction.

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 necessitates leak testing of the MSIVs by pressurizing between the 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, thus resulting in excessive leakage into the reactor vessel. The NRC staff considered this matter when the original test pressure of 25 psig was established for these MSIVs, at the design stage of the plant.

Since testing of the MSIVs at the reduced pressure between the valves 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, FRC finds that TVA's proposal to test MSIVs at a pressure of 25 psig by pressurizing between the valves is an acceptable exemption to the requirements of Section III.C.2.

3.1.6 Type C Testing with Water in Lieu of Air or Nitrogen as a Medium

In Reference 5, TVA requested permanent exemption from the requirements of Appendix J to permit testing of approximately 59 isolation valves with water in lieu of air or nitrogen as a medium, stating that the systems involved could not be drained to permit the pneumatic tests. TVA also stated that water represented the medium which would be present in case of leakage from these valves during accident conditions.

In Reference 7, however, TVA stated that the request of Reference 5 had considered that Appendix J inferred that all valves be tested with air. Since the submittal of Reference 5, TVA determined that the real intent of Appendix J was to prevent containment air leakage to the outside atmosphere. In support of this contention, TVA referred to paragraphs II.D, II.N, III.C.2, and III.C.3 of Appendix J. Based upon this determination, TVA stated that the requests for exemptions for the 59 valves of Reference 5 were no longer necessary. TVA proceeded to identify the isolation valves at the Browns Ferry plant in four categories, describing the conformance with Appendix J associated with each as follows:

	Category	Conformance with Appendix J
1.	Valves to be tested with water as a medium with results converted to equivalent air leakage.	This category has been deleted by Reference 8. These valves are now tested with air.
2.	Valves water sealed by the suppression chamber.	Appendix J does not require air testing of these valves because atmospheric leakage is prevented by a water seal from the suppression pool throughout the post-accident period.
3.	Valves in safety systems which are water sealed.	Appendix J does not require air testing of these valves because atmospheric leakage is prevented by a closed loop, seismic Class I system which is water sealed throughout the post-accident period. These safety systems are designed so that no loss of water seal occurs despite a possible single active failure.
4.	Valves which are air tested.	Tested in accordance with Sections II.D, II.N, and III.C of Appendix J, except for the exemption for MSIVs.

Evaluation

FRC concurs with TVA's interpretation of the requirements of Appendix J as stated above. No further evaluation of this item is undertaken since exemptions from the requirements of Appendix J are no longer requested.

3.1.7 Type C Testing of Valves in the Reactor Building Closed Cooling Water (RBCCW) System

In Reference 7, TVA reinstated its request of Reference 3 which had been inadvertently omitted from Reference 5. In Reference 3, TVA had requested an exemption from the Type C testing requirements of Appendix J for the isolation valves of the RBCCW system. TVA's basis for this request is that the valves are in a closed-loop system external to the reactor process system, operate at a pressure greater than 75 psig (greater than design peak accident pressure), operate continuously, and were not designed to permit routine testing of the valves.

Evaluation

TVA's basis for this exemption request is that the RBCCW system is a closed system inside containment which continuously operates at pressures greater than containment accident pressure. However, in order for a closed system to qualify as a barrier to leakage which prevents the isolation valves from being relied upon to isolate the containment, the closed system must meet certain criteria relative to its post-accident integrity.

The criteria for a closed system to qualify as a containment isolation barrier are given in Standard Review Plan (SRP) 6.2.4. Among other things, the system must be protected against missiles and pipe whip, must be designed to seismic Category I, and must meet safety-class piping requirements. Unless all the requirements of SRP 6.2.4 are met, the system can be postulated to rupture, in which case the isolation valves will be relied upon to perform a containment isolation function and therefore must be Type C tested.

The closed system described by TVA in Reference 3 does not meet all the criteria of SRP 6.2.4. Consequently, valves 70-47 and 70-506 must be Type C tested since they will be relied upon to prevent the escape of containment air to the outside atmosphere in case of a post-accident rupture of the RBCCW system.

3.1.8 Type C Testing of Traversing In-Core Probe (TIP) System Valves

In Reference 7, TVA requested a permanent exemption from Type C testing requirements for the TIP ball valves (penetrations 35A through 35E) and a temporary exemption for the nitrogen supply to the TIP indexers (penetration 35F) until facilities can be installed to permit testing. TVA's basis for this request is that any addition of valves in penetrations 35A through 35E to permit testing could cause interference with or failure of the TIP probe as it passes through these valves. These penetrations are now subjected to the differential pressure of the Type A test, and in TVA's opinion, the cost and reduction in system reliability would not be offset by the improvement in containment integrity.

Evaluation

Although the TIP penetrations are small lines, because of the number of lines involved, the potential for leakage of containment atmosphere can be substantial and does not justify permanent exemptions. Furthermore, another BWR licensee has successfully tested these valves without installing additional valves in the lines by disconnecting the TIP tubes at fittings just inside the drywell. This technique is now in effect at several BWR units. Consequently, FRC finds that TVA's proposal to permanently exempt these lines from Type C testing is unacceptable and that these valves should be tested in accordance with Appendix J. A temporary exemption, while modifying the nitrogen supply to the TIP indexers, is acceptable.

3.2 CLARIFICATION OF THE REQUIREMENTS OF APPENDIX J

In Reference 5, TVA stated:

> "For clarification of the requirements of Appendix J, we wish to advise that, in summing Type C test results to determine whether Type B and C test results satisfy the

Appendix J limit (total less than 0.60 La), we sum path leakage--that is, the greater leak rate of either of the pair of valves in a leak path is assumed to be the path leak rate."

Evaluation

The purpose of Type C testing of containment isolation valves in accordance with Appendix J is two-fold. First, it provides for leak check of containment isolation barriers which are operated frequently and thereby more subject to degradation of integrity than the passive barriers (i.e., Type C tests are required at each shutdown for refueling and are not to exceed 2 years, whereas Type A testing occurs approximately every 40 months). Second, Type C testing verifies the leak-tightness of each isolation valve, whereas Type A testing verifies the leak-tightness of penetrations, generally with two shut isolation valves in series. Consequently, the Type C test provides for the case in which a single active failure causes one of the two isolation valves in series to remain open.

By summing path leakage, TVA achieves both of the desired results of the Type C testing program. Each valve is tested at the required frequency and the testing accounts for possible single active failure, where the valve with the lesser leakage of the two in series is conservatively assumed to have remained open. Consequently, FRC finds that TVA's procedure of summing path leakage, where the path leakage is assumed to be the greater leak rate of the two valves tested, is in accordance with the requirements of Appendix J.

One concern with TVA's procedure for summing path leakage should be noted. Namely, when the initial summation of the greater leakage rate of each pair of valves *exceeds* 0.6 La, such that repairs must be accomplished, the Licensee must be careful to ensure that post-repair summations continue to include only the greater leakage rate from each pair of valves. FRC's concern is that once repairs have been performed on one of the two valves of a particular penetration, the other valve may now be the one with the greater leakage rate. In this case, the path leakage rate is now the leakage rate of the valve that was not repaired rather than the new leakage rate of the recently repaired valve. As long as the Licensee ensures that path leakage rate is always the leakage rate of the greater of the two leakage rates for a particular path, there is no problem with the TVA procedure. FRC interprets TVA's statement to mean that, regardless of subsequent repairs, the total path leakage which must not exceed 0.6 La will always include the greater of the two leakage rates for a particular penetration. FRC's concern is expressed only to provide complete clarity.

4. CONCLUSIONS

Technical evaluations of the outstanding submittals by TVA, relative to the implementation of the requirements of 10CFR50, Appendix J, at Browns Ferry Nuclear Plant Units 1, 2, and 3, have been conducted. These evaluations include TVA's requests for exemption from the requirements of Appendix J as well as one item of clarification of the requirements. The conclusions of these evaluations are presented below:

- Instrument lines penetrating the reactor containment do not require draining and venting during Type A testing provided the lines are Type C tested as required by Section III.A.1.(d).

- A temporary exemption from the requirements of Appendix J to exclude draining and venting of the seal water supply to the reactor recirculation pumps during Type A testing is acceptable while a modification is being installed to permit future draining and venting. This modification, if not already accomplished, should be completed as soon as possible.

- TVA's exemption request to test containment airlocks once each operating cycle at a pressure of Pa is unacceptable. Airlocks must be tested at 6-month intervals at Pa as required by Appendix J, except that this testing interval may be extended up to one year if there have been no airlock operations since the last successful Pa air test and if a Pa test is performed following the next airlock opening.

- TVA's exemption request to test airlocks at 2.5 psig rather than at Pa after each opening is acceptable if the test is accomplished within 72 hours of each opening or every 72 hours during periods of frequent openings and if the test results are conservatively extrapolated to the Pa test results.

- TVA's exemption request to test main steam line drain valve FCV 1-55 in the direction opposite to that of its safety function is unacceptable. This valve must be tested in the direction of its safety function. TVA's exemption request to test steam supply valves to the RCIC and HPCI turbines, FCV 71-2 and 73-2, in a direction opposite to that of their safety functions is unacceptable. These valves should also be tested in the direction of their safety function.

- TVA's exemption request to test main steam isolation valves at 25 psig by pressurizing between the valves is acceptable because the procedure results in a conservative determination of the leakage rate through the valves.

- TVA withdrew exemption requests to test certain isolation valves with water in lieu of air or nitrogen because TVA's proposed testing is in compliance with the requirements of Appendix J.
- TVA's request to exempt reactor building closed cooling water valves 70-47 and 70-506 from Type C testing is not acceptable because these valves can be relied upon to perform a containment isolation function. These valves should be Type C tested.
- TVA's exemption request to exclude the traversing in-core probe ball valves from Type C testing is unacceptable. These valves must be tested in accordance with Appendix J. A temporary exemption while modifying the nitrogen supply to the trip indexers is acceptable; however, the modifications, if not yet accomplished, should be completed as soon as possible.
- TVA's interpretation of the requirements of summing the leakage from Type C tests to determine acceptability satisfies the requirements of Appendix J. The Licensee's proposed method of summing the path leakage from Type C tests is acceptable provided that the path leakage will be rechecked after repairs.

5. REFERENCES

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