TECHNICAL EVALUATION REPORT

# CONTAINMENT LEAKAGE RATE TESTING

## IOWA ELECTRIC LIGHT AND POWER COMPANY
## DUANE ARNOLD ENERGY CENTER UNIT 1

NRC DOCKET NO. 50-331

NRC TAC NO. 08718

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FRC ASSIGNMENT 1

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

# 1. BACKGROUND

On August 7, 1975 [1], the Nuclear Regulatory Commission (NRC) requested Iowa Electric Light and Power Company (IEL) to review its containment leakage testing program for Duane Arnold Energy Center Unit 1 (DAEC) and to provide a plan for achieving full compliance with 10CFR50, Appendix J, where necessary. The review was to include appropriate design modifications, changes to technical specifications, and requests for exemption from the requirements pursuant to 10CFR50.12.

IEL replied on October 13, 1975 [2], listing several areas where differences existed between the current technical specifications at DAEC and 10CFR50, Appendix J. IEL further stated that the apparent differences would be reviewed prior to proposing technical specification changes or requests for exemption from the regulation. Following an exchange of correspondence with the NRC, IEL submitted an Application for Amendment of DPR-49 on August 29, 1978 [3]. This letter responded to an NRC request for additional information relative to the differences identified in Reference 2, provided technical specifications changes for DAEC reflecting these responses, and proposed additional changes along with supporting rationale.

The purpose of this report is to provide technical evaluations of all outstanding issues pertaining to the implementation of 10CFR50, Appendix J, at DAEC. Consequently, it provides technical evaluations of the potential exemptions from the requirements of Appendix J submitted by Reference 2 and amplified in Reference 3 and also provides technical evaluations of the proposed changes to the technical specifications submitted in Reference 3.

## 2. EVALUATION CRITERIA

Code of Federal Regulations, Title 10, Part 50 (10CFR50), Appendix J, Containment Leakage Testing, was the criteria for the evaluation of these submittals. Furthermore, in recognition of plant-specific conditions which could lead to a request for exemption not explicitly covered by the regulation, the NRC directed that technical reviews constantly emphasize the basic intent of Appendix J, that potential containment atmospheric leakage paths be identified, monitored, and maintained below established limits.

# 3. TECHNICAL EVALUATION

## 3.1 EXEMPTIONS FROM THE REQUIREMENTS OF APPENDIX J

In Reference 2, IEL identified several areas where differences existed between the current technical specifications at DAEC and 10CFR50, Appendix J. Reference 3 provided additional information related to these differences. Each of these potential exemptions from the requirements of Appendix J is evaluated in the following paragraphs.

### 3.1.1 Local Leak Rate Testing of Isolation Valves

#### 3.1.1.1 Feedwater, HPCI, and RCIC Injection Isolation Valves (Penetrations X-9A and X-9B)

In Reference 2, IEL proposed to continue testing the valves associated with the isolation of penetrations X-9A and X-9B with water in lieu of air (valves V-14-1, MO-4442, MO-2512, MO-2740, V-14-3, MO-4441, and MO-2312). In Reference 3, however, IEL committed to replace the inboard feedwater isolation valves by the end of the 1980 refueling outage with valves capable of being air-tested. IEL stated that, because of this modification, valves V-14-1, V-14-1, MO-4442, MO-2512, MO-2740, V-14-3, MO-4441, and MO-2312 will be air-tested.

Evaluation

Based upon IEL's commitment to modify the inboard feedwater isolation valves, there is no longer a need for an exemption for penetrations X-9A and X-9B because the Type C testing requirements of Appendix J will be met. IEL's plan to modify the valves by the end of the 1980 refueling outage is acceptable, and therefore, no further evaluation is required regarding these valves.

#### 3.1.1.2 RHR Shutdown Cooling Supply (Penetration X-12)

In Reference 3, IEL stated that RHR shutdown cooling supply valves MO-1908 and MO-1909, associated with penetration X-12, should be deleted from

Type C testing requirements since these valves do not meet any of the containment isolation valve criteria as listed in Section II.H of Appendix J. IEL further stated that, since all containment boundaries are passive, except for the pumps which are redundant, no single active failure will cause a loss of the containment function.

Evaluation

Sections II.H and III.A.1(d) of Appendix J identify the containment isolation valves which may require Type C testing. Furthermore, Section II.B defines containment isolation valves as those valves which are relied upon to perform a containment isolation function.

The RHR system is designed to engineered-safety-feature-system standards to ensure that it will remain operational and water filled throughout the period following a postulated LOCA. IEL has stated, and FRC concurs, that there is no single active failure which will cause a loss of the containment function. Therefore, there is no potential for leakage of containment atmosphere through penetration X-12, and valves MO-1908 and MO-1909 are not relied upon to perform a containment function.

Consequently, deletion of these valves from Type C testing is acceptable because Appendix J does not require testing. No exemption from Appendix J is required.

3.1.1.3 Core Spray Pump Discharge Valves (Penetrations X-16A and X-16B)

In Reference 3, IEL proposed to delete core spray pump discharge valves MO-2115, MO-2117, MO-2135, and MO-2137 from the list of valves to be Type C tested because that the core spray system is a seismic Class I system and that "the core spray system external to the containment is the second boundary whose integrity is proven periodically during system operational checks."

In Reference 4, IEL provided additional information relative to the system operational checks of the core spray system. IEL reported that the system operational checks have now become part of the "Integrity of Systems Outside Containment" tests that are conducted each refueling cycle to meet the requirements of NUREG-0578 as developed by the BWR Owner's Group. For the core spray system, IEL reported that tests are performed quarterly at a minimum pressure of 113 psig (Pa at DAEC is 54 psig). The tests are performed under a preventive maintenance program designed to maintain system leakage as low as practical, with inspections being performed in conjunction with the system pressure tests required by Section XI of the ASME Boiler and Pressure Vessel Code.

Evaluation

The core spray system is a two-independent-loop system, each loop containing a single pump. Under expected post-accident conditions, there is no possibility of leakage of containment atmosphere through this system because the system will be operating with a water pressure higher than peak containment accident pressure. However, should one of the pumps fail to start under accident conditions, containment atmosphere would enter the system and the system outside containment would become a potential path for the leakage of air beyond the containment boundary.

IEL proposes to delete the four motor-operated isolation valves located outside containment (two in series in each loop) from the list of valves to be Type C tested. IEL's position is that the core spray system external to the containment provides the leakage boundary and that this boundary is tested quarterly. The testing is performed at a minimum of 113 psig with an acceptance criterion requiring as-low-as-practical leakage. The system is a seismic Class I system and is designed to remain intact following a postulated accident.

However, in order to demonstrate that the containment isolation valves of the core spray system are not relied upon to perform a containment isolation function, it is necessary to demonstrate that the valves remain water sealed throughout the post-accident period. Therefore, the periodic test of the system outside containment would need to actually measure an integrated system liquid leakage rate and compare the measured rate with that leakage rate which will just exhaust the available water inventory inside containment between the area of the break and the first isolation valve outside containment during the period when the containment is pressurized following the accident. If the measured integrated system leakage rate is lower than the calculated rate, the test would demonstrate that the first isolation valve outside containment would remain water sealed throughout the post-accident period. In this condition, the isolation valve is not relied upon to prevent the escape of containment air to outside atmosphere throughout the post-accident period; therefore, the valve does not qualify as a containment isolation valve in accordance with Section II.B of Appendix J and does not require Type C testing.

Unless actual testing demonstrates that the first isolation valve remains water covered throughout the post-accident period (demonstrated with the periodicity of the Type C tests), there is no technical basis for determining that the isolation valve is not relied upon to perform a containment isolation function in accordance with Appendix J. Therefore, Type C testing of the containment isolation valves is required.

3.1.1.4 CRD Return Line (Penetration X-36)

In Reference 2, IEL proposed to test valves V-17-52 and V-17-53 with water in lieu of air. In Reference 3, however, IEL stated that penetration X-36 would be deleted from the system by capping the penetration on both sides of the containment boundary, and therefore valves V-17-52, V-17-53, and V-17-54 would no longer require testing.

Evaluation

Capping of the penetration on both sides of the containment boundary eliminates these valve from Type C testing requirements since they no longer will be relied upon for any containment isolation function. Consequently, the valves do not require Type C testing and no exemption from Appendix J is required.

3.1.1.5 RCIC and HPCI Condênsate Return Isolation Valves (Penetrations X-10 and X-11)

In Reference 3, IEL stated that RCIC condensate return isolation valves CV-2410 and CV-2411 (penetration X-10) and HPCI condensate return isolation valves CV-2211 and CV-2212 (penetration X-11) should be deleted from the list of valves requiring Type C testing because these valves are beyond the second boundary and therefore do not require Type C testing.

Evaluation

The steam side piping of the RCIC and HPCI systems is essentially identical. For simplicity, this evaluation will discuss the RCIC system but will, in effect, apply to both systems.

The RCIC system (steam side) is basically a single-loop system consisting of a 4-inch high pressure steam inlet line, a turbine drive, and a 10-inch condensate return line. The high pressure steam inlet line connects to a 20-inch main steam header inside containment and passes through penetration X-10. Normally open isolation valves MO-2400 and MO-2401 are located in the 4-inch high pressure steam inlet line on both sides of the containment penetration. The condensate return line passes through penetration N-212 and terminates below the water level of the suppression pool. Check valve V-24-23 and locked-open manual globe valve V-24-8 are located in this line, outside of penetration N-212.

A condensate drain pot is located in the high pressure steam line between the outboard isolation valve (MO-2401) and the inlet to the turbine drive. Condensate collected in the drain pot returns to the main condenser via normally open isolation valves CV-2410 and CV-2411. Upon receipt of an RCIC initiation signal, steam line isolation valves MO-2400 and MO-2401 remain open, while condensate return isolation valves CV-2410 and CV-2411 automatically shut to isolate the condensate drain path from the main condenser. Once shut, CV-2410 and CV-2411 cycle intermittently to drain condensate from the drain pot based upon a level control signal operating on drain pot level. At this point, with the RCIC system operating, only valves CV-2410 and CV-2411 prevent leakage of radioactive steam and gases to the atmosphere via the main condenser (in a post-accident condition, there is no guarantee that main condenser off-gas discharge to atmosphere is prevented by the non-safety-related off-gas processing). Once the system is secured or if isolation valves MO-2400 and MO-2401 are shut for other reasons, containment boundary is shifted back to penetrations X-10 and N-212 and leakage past CV-2410 and CV-2411 is no longer significant.

Section II.H of Appendix J requires that containment isolation valves of the main steam system of a boiling water reactor (BWR), as well as containment isolation valves which operate intermittently after an accident, be tested in accordance with Type C testing procedures. Section II.B defines containment isolation valves as those valves which are relied upon to perform a containment isolation function. In view of the foregoing discussion, it is concluded that valves CV-2410 and CV-2411 are relied upon to isolate a potential leakage path from the main steam system of a BWR to the atmosphere during the period when the RCIC system is operating after an accident; therefore, these valves must be Type C tested. Furthermore, a 3/4-inch test line with two isolation valves (V-24-28 and V-24-29) has been located between CV-2410 and CV-2411 specifically to permit this testing. Consequently, IEL's proposal to delete these valves from Type C testing is unacceptable.

Similarly, IEL's proposal to delete HPCI valves CV-2211 and CV-2212 (penetration X-11) from Type C testing is unacceptable. These valves should continue to be Type C tested for the same reasons cited above for the comparable valves in the RCIC system.

3.1.1.6 Main Steam Isolation Valves (Penetrations X-7A, X-7B, X-7C, and X-7D)

In Reference 2, IEL proposed to continue testing main steam line isolation valves (MSIVs) in accordance with existing technical specifications which require testing with air or nitrogen at a pressure of 24 psig between the valves.

<u>Evaluation</u>

Section III.C of Appendix J requires that local leak rate testing be performed at peak calculated accident pressure (Pa), 54 psig at DAEC. Consequently, IEL's proposal requires an exemption from Appendix J to permit the reduced pressure testing.

The main steam system design 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. A test pressure of Pa acting on the inboard disc, however, lifts the disc off its seat; this result in excessive leakage into the reactor vessel and prevents the performance of a meaningful test. Nevertheless, testing by pressurizing between the valves at a reduced pressure is feasible because the reduced pressure does not exert a sufficient force on the disc of the inboard valve to cause it to unseat. It was this consideration which established a valve test pressure of approximately 25 psig during the design stages of the majority of operating BWR units.

From a containment leakage testing standpoint, testing the MSIVs by pressurizing between the valves at a reduced pressure is acceptable because the test results are inherently conservative. In all cases, testing of these valves by exerting a pressure of 54 psig in the direction of accident pressure will result in a larger seating force on the valves than will exist when pressurizing between the valves at reduced pressure. In the case of the inboard valves, testing between the valves is extremely conservative because the test pressure is tending to unseat the inboard valves while accident pressure would always be acting to seat them.

At DAEC, a test pressure of 24 psig was selected because this pressure is equivalent to the column of water against the inboard MSIV when the line between the valve and the reactor vessel is flooded. The significance of this pressure is that it provides the capability to perform the between-the-valves reduced pressure test with zero differential pressure across the inboard MSIV when testing to determine exactly which of the valves may be leaking excessively.

In view of the above discussion, testing of the MSIVs at DAEC by pressurizing between the valves to 24 psig with air or nitrogen is an acceptable exemption to the Type C testing requirements of Appendix J.

#### 3.1.1.7 Valves Water Pressurized Throughout the Accident (Penetrations N-210A & B, N-211A & B, N-224, N-225A & B, N-226, N-227A & B, X-17, X-39A & B)

In Reference 2, IEL listed several valves which it interpreted as not requiring Type C testing in accordance with Appendix J, Section II.H, because these valves were required to remain open or would remain water pressurized for the duration of the accident. In Reference 3, IEL further stated that this containment isolation function was single-active-failure protected, that redundant pumps existed to provide pressurization, that the loops could be cross-connected using cross-ties, and that the loops had redundant valves so that loop pressure could be maintained. The valves in this category were the RHR suppression pool suction, the core spray suppression pool suction, the RCIC and HPCI suppression pool suctions, the LPCI injection, the suppression pool spray, the RHR test line, the vessel head spray, and the containment spray.

Evaluation

Appendix J identifies containment isolation valves which require Type C testing. Section II.B defines containment isolation valves as those valves relied upon to perform a containment isolation function, i.e., those valves which are relied upon in a post-accident condition to prevent the escape of containment air to the outside atmosphere.

The valves which IEL has identified above are part of engineered-safety-feature (ESF) systems and are designed to remain functional after an accident. FRC concurs with IEL that loop pressure can be retained in these systems despite a possible single active failure because of the redundancy designed into the RHR system. The normally shut crosstie valves are not important to this analysis because each RHR loop contains two pumps which are cross-connected by normally open manual valves. However, because of the particular operating characteristics of the RHR system in its LPCI mode, a more detailed review of the specific lines involved is necessary.

The piping configurations of concern are presented in Figures 1 and 2. Figure 1 shows the HPCI, RCIC, and core spray suction lines and one loop of the suction, suppression pool spray, and RHR test lines. Figure 2 shows one loop of LPCI injection, RV head spray, and containment spray. As can be seen in Figure 1, the HPCI, RCIC, core spray, and RHR suction lines are isolated from the containment atmosphere by the water level in the suppression pool. Since these lines are continuously water filled in a post-accident condition,

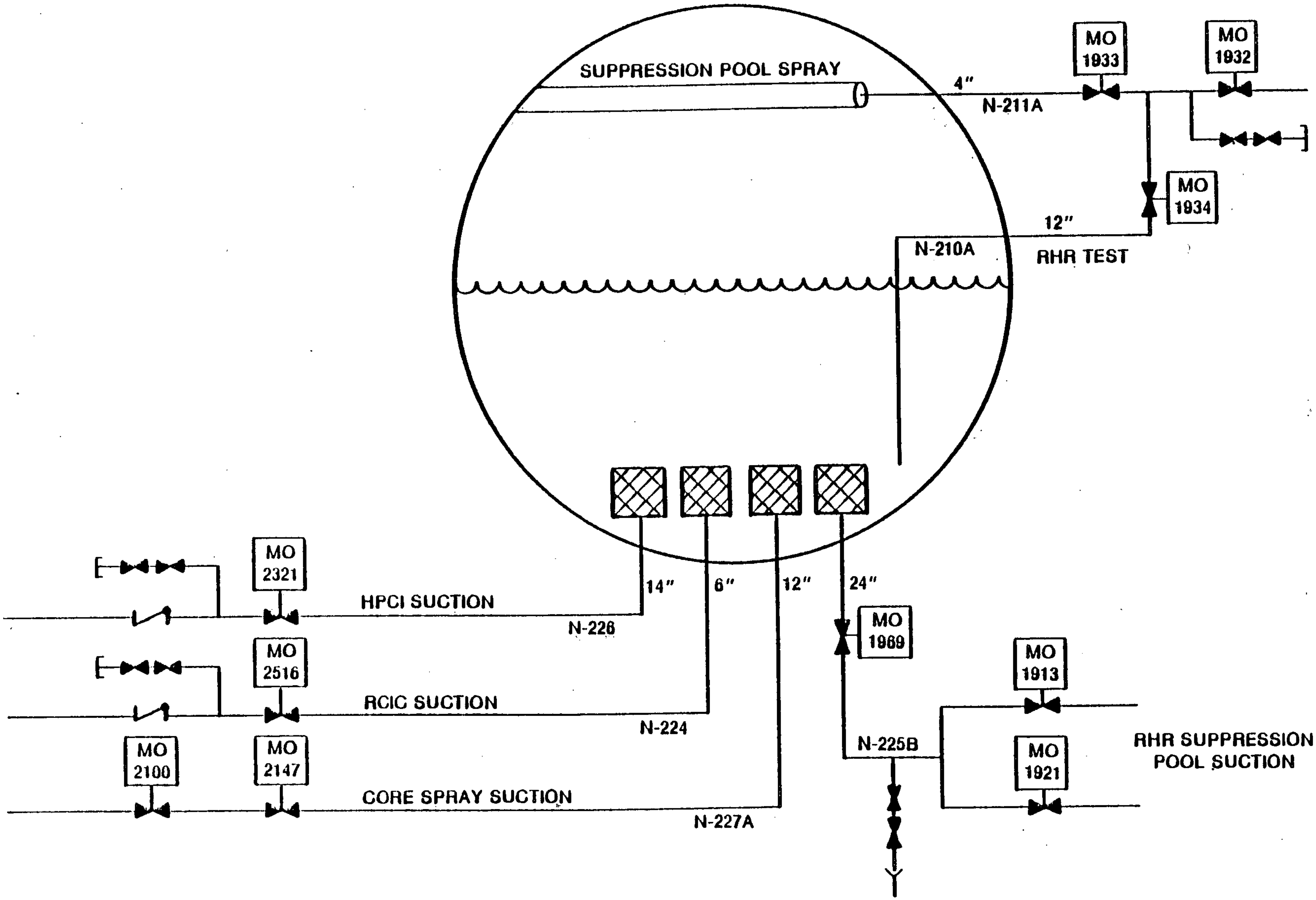
SUPPRESSION POOL SPRAY
4"
N-211A
MO 1933
MO 1932
MO 1934
12"
N-210A
RHR TEST
MO 2321
HPCI SUCTION
N-226
14"
6"
12"
24"
MO 1969
MO 2516
RCIC SUCTION
N-224
MO 1913
N-225B
MO 2100
MO 2147
MO 1921
RHR SUPPRESSION POOL SUCTION
CORE SPRAY SUCTION
N-227A

Figure 1.

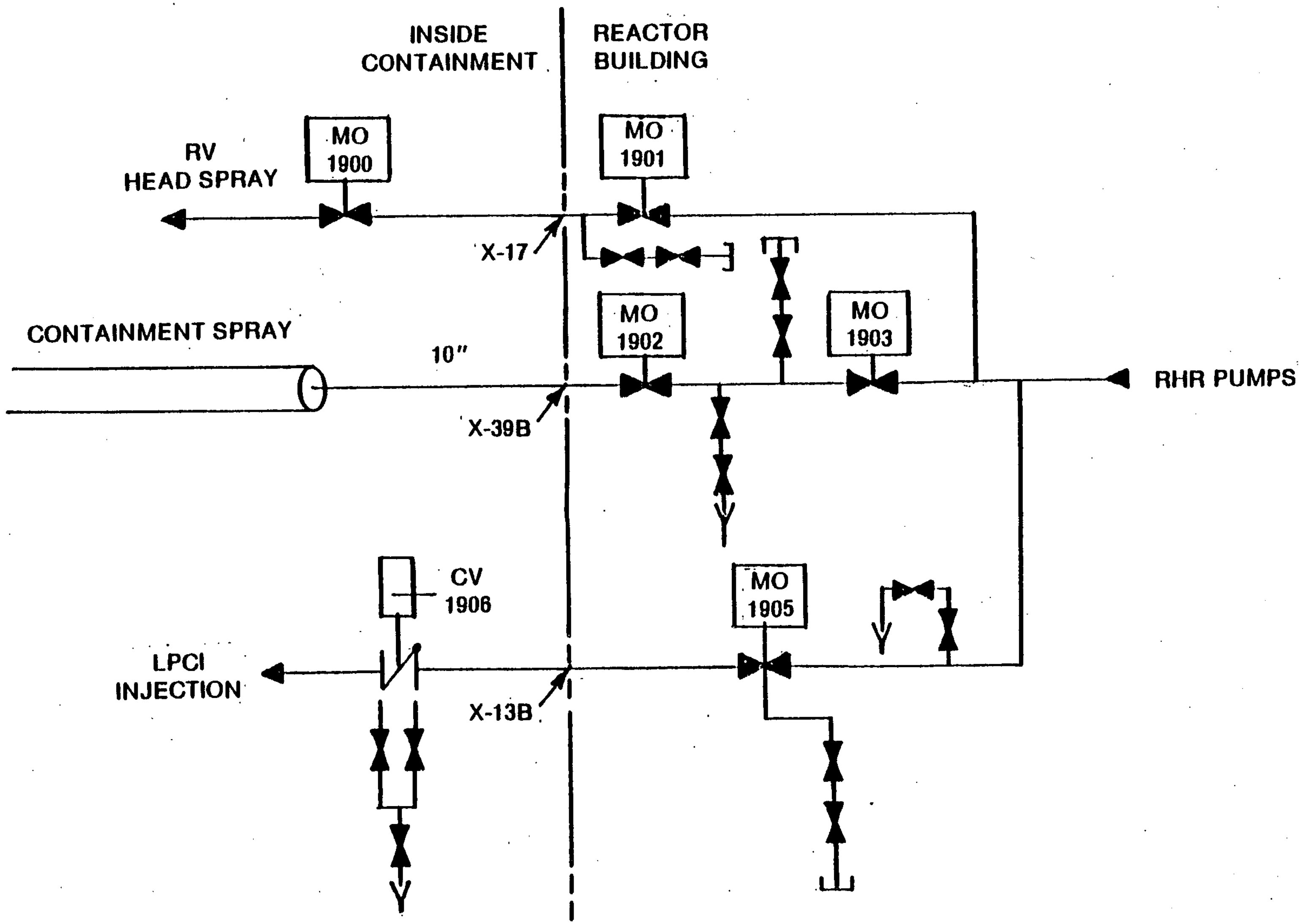
INSIDE CONTAINMENT
REACTOR BUILDING
RV HEAD SPRAY
MO 1900
MO 1901
X-17
CONTAINMENT SPRAY
10"
MO 1902
MO 1903
RHR PUMPS
X-39B
CV 1906
MO 1905
LPCI INJECTION
X-13B

Figure 2.

the isolation valves are not relied upon to prevent the escape of containment air to outside atmosphere; therefore, Type C testing is not required by Appendix J. Similarly, because the RHR test line terminates below the level of the pool, its isolation valve is also isolated from containment atmosphere, and Type C testing of this line is not required.

The LPCI injection line will be normally open and filled with water at a pressure greater than containment accident pressure as soon as safety injection is initiated. Furthermore, should valve MO-1905 (Figure 2) fail to open, the valve will be water sealed by RHR water at pump head pressure, and no single active failure can cause a loss of this pressure. Since MO-1905 is a gate valve, the water pressure will unseat the upstream valve disc and pressurize the valve packing and body-to-bonnet seal area with water. Consequently, there is no path for containment air leakage to the atmosphere through this line, even in the case of air leakage past the seat of check valve CV-1906. Therefore, this line is not a potential source of containment atmosphere leakage and the isolation valves are not required to be Type C tested in accordance with Appendix J.

Unlike the LPCI injection line the remaining three lines (suppression pool spray, containment spray, and RV head spray) are not automatically initiated by safety injection. Flow in these lines is left for manual initiation, if necessary, once sufficient reactor vessel level has been reestablished. Depending upon the severity of the accident, flow in these lines may not be established (particularly containment spray and suppression pool spray). Furthermore, at the start of an accident, there is no guarantee that there is any water in the line between the inboard and outboard isolation valves. In the case of these lines, therefore, there is a potential for containment air to escape to the outside atmosphere through the valve packing or body-to-bonnet seal area of the inboard isolation valve, even though the outboard valve is water sealed, as described in the case of valve MO-1905 of the LPCI injection line.

In the case of the reactor vessel head spray line, the inboard isolation valve is located inside containment (e.g., valve MO-1900). Leakage through the valve packing or body-to-bonnet seal is not a concern since any leakage is merely internal to the containment and does not escape to the outside atmosphere. Consequently, the isolation valves of this line are not relied upon to perform a containment isolation function and do not require Type C testing.

For both the containment spray line and the suppression pool spray lines, however, the inboard isolation valves are located outside containment (e.g., valves MO-1902, MO-1933, MO-1934). If any of these valves leak through the packing or body-to-bonnet seals, the leakage of containment air reaches the outside atmosphere. Consequently, Appendix J requires that these valves be Type C tested. However, since the packing and body-to-bonnet seals are the only potential sources of leakage, the testing may be limited to these particular areas. Valve MO-1902 in the containment spray line is also a gate valve. Testing this valve by pressurizing between valves MO-1902 and MO-1903 achieves the intent of Appendix J because this test will unseat the upstream disc of valve MO-1902 and will pressurize the area of concern. Valves MO-1933 and MO-1934, however, are globe valves. FRC does not have sufficient information to determine whether the packing area is isolated from the containment side of the line when the valve is shut. However, assuming this is the case, these valves may also be tested by pressurizing between valves MO-1932, MO-1933, and MO-1934 since the area of concern will be subjected to the test pressure. If this is not the case, valve MO-1933 must be tested in the direction of accident pressure (note: by pressurizing between the three valves, MO-1934 is tested in the direction of accident pressure since its function in this case is to isolate the suppression pool spray line rather than the RHR test line).

In summary, Type C testing is not required and no exemption is necessary for the following penetrations because Appendix J does not require testing: N-210A & B, N-224, N-225A & B, N-226, N-227A & B, and X-17. For penetration X-39A & B, the inboard isolation valves should be tested in the direction of accident pressure or by pressurizing between the inboard and outboard isolation valves in order to test the valve packing and body-to-bonnet seals of the inboard valves. For penetration N-211A & B, the inboard isolation valves should be tested in the direction of accident pressure or by pressurizing between the inboard and outboard valves provided that this testing will expose the packing and body-to-bonnet seal areas of the inboard valves to the test pressure.

3.1.1.8 Submerged Lines (Penetrations N-212, N-214, N-222)

In Reference 2, IEL stated that the suppression pool penetration lines of the RCIC and HPCI turbine exhausts do not require Type C testing since any leakage through these valves would be water leakage because of submergence of the ends of the lines in the suppression pool. In Reference 3, IEL further stated: "Since the leakage will only consist of water, it is considered conservative to add the water leakage to the air leakage and require that the total leakage will remain within the Technical Specification limits."

Evaluation

The valves in question, V-24-8 and V-24-23 (penetration N-212), V-22-16 and V-22-17 (penetration N-214), and V-22-21 and V-22-22 (penetration N-222), are continuously water sealed by the water pressure-head of the suppression pool. The water level of the suppression pool is maintained throughout the post-accident period and therefore any leakage past these valves will be water leakage.

IEL has stated that since any leakage past these valves is water leakage, it is conservative to add the water leakage to the air leakage and to require that the total leakage remain within the technical specification limits. FRC agrees with this statement. Since IEL's proposal is conservative with respect to the requirements of Appendix J, no exemption is required.

3.1.2 Containment Airlocks

In Reference 3, IEL proposed to test containment airlocks at a pressure of Pa and at an interval not longer than one operating cycle. IEL further proposed that whenever the airlock was opened during the operating cycle, and containment integrity was required, the airlock gasket would be tested at Pa following closure if it had been greater than 3 days since the last leakage test.

Evaluation

Appendix J, Section III.D.2 requires that airlocks be tested at 6-month intervals and that airlocks which are opened during the 6-month intervals be tested after each use. Airlocks represent a potentially large leakage path that is more subject to human error than other isolation barriers; therefore, they are tested more often than other isolation barriers. In addition, to ensure that the sealing mechanisms were not damaged during an airlock entry and to ensure that these large potential leakage paths were correctly secured after use, the requirement to test after each use was added.

For certain types of reactors, airlocks have been used frequently. Testing of airlocks after each opening, therefore, may create a situation which results in more rapid degradation of the critical isolation barriers being tested. Moreover, experience obtained since 1969 from the testing of airlocks indicates that only a very few airlock tests have resulted in greater than allowable leakage rates. This infrequent failure of airlock test plus the possibility that excessive testing could lead to a loss of reliability due to equipment degradation leads to the conclusion that testing after each opening may be undesirable. As a compromise between the various interests, the requirement to test after each opening has been defined as within 3 days of each opening or every 3 days during periods of frequent openings. By this definition, the intent of Appendix J that airlock integrity be verified within a reasonable period of time after use is achieved without the excessive testing that would otherwise be required when a series of entries (every few hours) occurs within a short period of time.

IEL's proposal to test airlock gaskets within 3 days of an airlock opening is acceptable. However, IEL's proposal to test the entire airlock at a pressure of Pa once per operating cycle is not acceptable. This proposal does not make adequate allowances to detect potential deterioration of airlocks through normal use, to detect possible damage to the door mechanism, to detect potential damage to door seals through moving equipment into and out of containment, and to detect possible fouling of seals during closure. Testing of the entire airlock assembly at a pressure of Pa should be conducted at the 6-month interval required by Appendix J.

## 3.2 PROPOSED TECHNICAL SPECIFICATION CHANGES

In Reference 3, IEL provided proposed technical specification changes concerning containment leakage rate testing. These changes reflected the proposed exemptions from the requirements of Appendix J discussed in Section 3.1 above as well as other potential changes. IEL stated that all design modifications required to implement the technical specification revisions were anticipated to be completed by the end of the 1980 refueling outage. The following paragraphs provide a technical evaluation of these proposed changes.

### 3.2.1 Containment Penetrations Subject to Type B Test Requirements (Table 3.7-1)

The proposed revision to Table 3.7-1 provides for changes in the testing requirements for containment airlocks and also adds the requirements to test a flange "O"-ring in penetration 213.

Evaluation

Note 2 of Table 3.7-1 regarding the testing of containment airlocks reads as follows:

> "To be tested at least each operating cycle. Gasket to be tested following closure whenever airlock is opened, providing that containment integrity is required and it has been greater than three (3) days since last leakage test."

As discussed in Section 3.1.2 of this report, the first sentence of this note is unacceptable and should be changed to read: "To be tested at least once every 6 months." The second sentence of the note is acceptable as a requirement of Appendix J as also discussed in Section 3.1.2 of this report.

The addition of the testing requirement for the flange "O"-ring in penetration 213 is in accordance with Appendix J and is therefore acceptable.

Consequently, IEL's proposed revision to Table 3.7-1 is acceptable provided that airlock testing is required at least once every 6 months.

3.2.2 <u>Containment Isolation Valves Subject to Type C Test Requirements (Table 3.7-2)</u>

The proposed revision to Table 3.7-2 provides for the addition and deletion of several valves from this listing of valves which require Type C testing in accordance with Appendix J. Each of the proposed changes to this table is evaluated separately in the following paragraphs.

3.2.2.1 Deletion of Valves Which Do Not Perform a Containment Isolation Function

IEL proposed to delete the following valves from Table 3.7-2 because they do not perform a containment isolation function:

| | | |
|---|---|---|
| V-14-2 | V-14-4 | CV-2212 |
| CV-2410 | V-17-80 | V-17-84 |
| CV-2211 | CV-2411 | V-22-60 |

<u>Evaluation</u>

In Section 3.1.1.5 of this report, the deletion of valves CV-2410, CV-2411, CV-2211, and CV-2212 from Type C testing was found unacceptable because, when the RCIC or HPCI systems are in operation after an accident, these valves are relied upon to perform a containment isolation function in view of a potential leakage path from the main steam system of a BWR to the environment. Consequently, these valves should not be deleted from Table 3.7-2.

Valves V-14-2, V-14-4, V-17-80, V-17-84, and V-22-60 do not perform a containment isolation function and can be deleted from Table 3.7-2 since the regulation does not require that they be tested. These valves are normally open manual valves installed to permit testing and/or maintenance of the first containment isolation valve of a particular penetration.

3.2.2.2 Valves Which Do Not Meet the Criteria of Section II.H of Appendix J

IEL proposed to delete valves MO-1908, MO-1909, MO-2115, MO-2117, MO-2135, and MO-2137 from Table 3.7-2 because they do not meet the criteria of Section II.H of Appendix J.

Evaluation

In Section 3.1.1.2 of this report, it was found that valves MO-1908 and MO-1909 do not require Type C testing in accordance with the requirements of Appendix J because they are not relied upon to perform a post-accident containment isolation function. They should be deleted from Table 3.7-2.

In Section 3.1.1.3, however, it was found that valves MO-2115, MO-2117, MO-2135, and MO-2137 should be Type C tested unless the Licensee's testing of the core spray system outside containment is used to demonstrate that the isolation valves remain water sealed throughout the post-accident period. These valves should not be deleted from Table 3.7-2 until such procedures are established.

3.2.2.3 Valves in a Closed System Inside Containment

IEL proposed to delete the following valves from Table 3.7-2 because, in accordance with 10CFR50, Appendix A, GDC 57, the redundant barriers are a single isolation valve outside containment and a closed system inside and, therefore, testing of only the isolation valve outside containment is required:

| | |
|---|---|
| V-57-62 | V-57-65 |
| V-57-66 | V-12-65 |
| V-12-64 | V-12-63 |
| V-12-62 | V-12-66 |
| V-57-61 | V-12-68 |

Evaluation

IEL states that the isolation valves of these penetrations were installed in accordance with GDC 57 and, consequently, only the isolation valve outside containment requires Type C testing. FRC is unable to independently confirm that each of these penetrations qualifies as a GDC 57 penetration under present-day requirements for closed systems. Nevertheless, each of the valves in question is a normally open, manual isolation valve located inside containment. As such, they will be inaccessible under post-accident conditions and are clearly not relied upon to perform a post-accident containment isolation function. Consequently, they are not containment isolation valves in accordance with the definition of Section II.B of Appendix J and therefore do not require Type C testing. FRC concurs with IEL's proposal to delete these valves from Table 3.7-2.

3.2.2.4 Penetration Being Deleted

IEL proposed to delete valves V-17-54, V-17-52, and V-17-53 from Table 3.7-2 because the associated penetration is being deleted.

Evaluation

Based upon IEL's statement in Reference 3 that all modifications necessary to implement the revised technical specifications were anticipated for completion by the end of the 1980 refueling outage, the deletion of these valves from the list of those to be tested is acceptable.

3.2.2.5 Addition of Valves to the Testing List

IEL listed several valves which are to be added to Table 3.7-2. Among others, valves V-24-8, V-24-23, V-22-16, V-22-17, V-22-21, and V-22-22 were added to the table.

Evaluation

With regard to this evaluation, FRC has no comment where the Licensee determines that additional valves should be tested since it only adds conservatism to the containment leakage testing program.

3.2.2.6 Reverse Direction Testing

IEL indicated that certain valves were tested in the direction opposite the pressure existing in a post-accident condition (reverse-direction testing).

In each instance, IEL stated that the results of the reverse-direction testing would be equivalent to or more conservative than testing in the direction of post-accident pressure.

Evaluation

Appendix J, Section III.C, permits reverse-direction testing provided the results are equivalent to or more conservative than results of testing in the direction of post-accident pressure. Consequently, the Licensee's proposed testing is acceptable because it is in accordance with Appendix J. The Licensee should retain onsite documentation of the determination that the reverse-direction testing is equivalent or more conservative than testing in the direction of post-accident pressure.

3.2.3 Miscellaneous Changes to the Technical Specifications

IEL proposed to replace pages 3.7-3 through 3.7-9, 3.7-20 through 3.7-24, 3.7-37, 3.7-38, and 3.7-49 with replacement pages of the same numbers. Table 3-1 of this report provides an evaluation of each of the proposed changes.

Table 3-1

Proposed Technical Specification Changes

| Page No. | IEL's Proposed Wording | Appendix J Requirement | FRC Evaluation |
|---|---|---|---|
| 3.7-3 | a. Type A Tests | | |
| | 7) Initial Leakage Rate Tests | | |
| | a) Prior to initial operation a test shall be performed at 27 psig (Pt, reduced pressure) which is 0.5 Pa, to measure a leakage rate Ltm. | Section III.A.4 requires an initial test be performed at a pressure not less than 0.5 Pa. | The proposed wording complies with Appendix J and therefore is acceptable. |
| | b) A second test shall be performed at 54 psig (Pa peak pressure) to measure a leakage rate Lam. | Section III.A.4 also requires a second preoperational test be performed at Pa. | The proposed wording complies with Appendix J and therefore is acceptable. |
| | c) La is defined as the design basis accident leakage rate of 2.0 weight percent of contained air per 24 hours at 54 psig. | Section II.K defines La as the technical specification leakage limit in percent per 24 hours at Pa. | This section complies with Appendix J and therefore is acceptable. |
| 3.7-4 | a. Type A Tests | | |
| | 8) Periodic Leakage Rate Tests | | |
| | Periodic leakage rate tests shall be performed at peak pressure Pa. | Section III.A.5 permits periodic leak tests to be performed at Pt or Pa. | The proposed wording complies with Appendix J and therefore is acceptable. |

Table 3-1 (Cont.)

| Page No. | IEL's Proposed Wording | Appendix J Requirement | FRC Evaluation |
|---|---|---|---|
| 3.7-4 | a. Type A Tests | | |
| | 9) Acceptance Criteria | | |
| | Peak pressure test. (Pa) The leakage rate Lam shall be less than 0.75 (La). | Section III.A.5 requires Lam be less than 0.75 La. | The proposed wording complies with Appendix J and therefore is acceptable. |
| | b. Type B Tests | | |
| | 1) Test Pressure | | |
| | All preoperational and periodic Type B tests shall be performed by local pneumatic pressurization of the containment penetrations, either individually or in groups, at a pressure not less than Pa. | Section III.B.2 requires tests of containment penetrations be performed by local pneumatic pressurization, either individually or in groups, at a pressure not less than Pa. | The proposed wording complies with Appendix J and therefore is acceptable. |
| 3.7-5 | c. Type C Tests | | |
| | 4) The leakage rate from any containment isolation valve whose seating surface remains water covered post-LOCA, and which is hydrostatically Type C tested, shall be included in the Type C test total. These valves are identified in Table 3.7-2 of this Technical Specification. | Section III.C.2 requires that isolation valves be tested with air or nitrogen as a medium unless sealed by a seal water system. | As discussed in Section 3.1.1.8 of this report, this provision is conservative with respect to the requirements of Appendix J and is therefore acceptable. |

Table 3-1 (Cont.)

| Page No. | IEL's Proposed Wording | Appendix J Requirement | FRC Evaluation |
|---|---|---|---|
| 3.7-6 | d. Periodic Retest Schedule | | |
| | 2) Type B Tests | | |
| | a) Penetrations and seals of this type (except airlocks) shall be leak tested at 54 psig every other reactor shutdown for major fuel reloading. | Section III.B requires that containment penetrations be tested at a pressure of Pa. For penetrations provided with a pressurization system, Section III.D requires testing at every other shutdown for refueling, not to exceed 3 years (except for airlocks). | The proposed wording should be modified to include the limitation on exceeding 3 years between testings. |
| | b) The personnel airlock shall be pressurized to 54 psig and leak tested at an interval no longer than one operating cycle. Whenever the airlock is opened during the operating cycle, and containment integrity is required, and it has been greater than (3) days since the last leakage test, the airlock gasket shall be leak tested at 54 psig following airlock closure. | Section III.D.2 requires that containment airlocks be tested at a pressure of Pa once every six months and also after each opening when opened in the interval between 6-month tests. | As discussed in Section 3.1.2 of this report, IEL's proposal to test airlocks once per cycle is unacceptable. This proposed technical specification should be modified to provide for a full airlock test at Pa once every 6 months. IEL's proposal to test airlock gaskets at 54 psig within 3 days of an opening when containment integrity is required is acceptable as discussed in Section 3.1.2 of this report. |

Table 3-1 (Cont.)

| Page No. | IEL's Proposed Wording | Appendix J Requirement | FRC Evaluation |
|---|---|---|---|
| 3.7-8 | f. Reporting<br><br>The Type A test summary report shall include an analysis and interpretation of the test data, the least-squares fit analysis of the test data, the instrumentation error analysis, and the structural conditions of the containment or components, if any, which contributed to the failure in meeting the acceptance criteria.<br><br>The Type B and C test summary report shall include an analysis and interpretation of the data and the condition of the components which contributed to the failure in meeting the acceptance criteria. | Section V.B.3 requires test results from Type A, B, and C tests that fail to meet acceptance criteria be reported, including an analysis and interpretation of data, the least-squares fit of the data, the instrumentation error analysis, and the structural conditions of the containment or components, if any, which contributed to the failure in meeting the acceptance criteria. | The proposed wording adequately provides for compliance with the requirements of Appendix J and therefore is acceptable. |

## 4. CONCLUSIONS

FRC has conducted technical evaluations of the outstanding issues pertaining to the implementation of 10CFR50, Appendix J, at DAEC, including the potential requests for exemption from the requirements of Appendix J submitted by IEL in Reference 2 and the proposed changes to the technical specifications at DAEC submitted by IEL in Reference 3. The conclusions resulting from these evaluations are summarized below in the following paragraphs.

<u>Potential Exemptions from Appendix J</u>

- No exemption from Appendix J is required for penetrations X-9A and X-9B as a result of IEL's commitment to modify the inboard feedwater isolation valves.

- Deletion of RHR shutdown cooling supply valves MO-1908 and MO-1909 (penetration X-12) from Type C testing is acceptable because Appendix J does not require testing of these valves. No exemption is required.

- Type C testing of core spray isolation valves MO-2115, MO-2117, MO-2135, and MO-2137 is required unless testing of the core spray system demonstrates that the first isolation valve remains water covered throughout the post-accident period.

- The isolation valves of penetration X-36 (V-17-52, V-17-53, and V-17-54) may be deleted from Type C testing since penetration X-36 will be capped on both sides of the penetration.

- IEL's proposal to delete RCIC and HPCI condensate return isolation valves from Type C testing is unacceptable because the valves are relied upon to perform a containment isolation function (i.e., isolate a direct path to the atmosphere from the main steam system of a BWR) when the RCIC or HPCI systems are in operation after an accident. Valves CV-2410, CV-2411, CV-2211, and CV-2212 should continue to be Type C tested.

- Main steam isolation valves may continue to be tested at 24 psig because the test will provide a conservative measure of the leakage existing at a pressure of Pa due to the design of the valves. Exemption from the Appendix J requirement to test these valves at Pa is acceptable.

- Type C testing is not required and no exemption is necessary for the following penetrations because Appendix J does not require testing: N-210A & B, N-224, N-225A & B, N-226, N-227A & B, and X-17. For penetration X-39B, the inboard isolation valves should be tested in the direction of accident pressure or by pressurizing between the inboard and outboard isolation valves in order to test the valve packing and body-to-bonnet seals of the inboard valve. For penetration N-211A & B, the inboard isolation valves should be tested in the direction of accident pressure or by pressurizing between the inboard and outboard valves provided that this testing will expose the packing and body-to-bonnet seal areas of the inboard valves to the test pressure.

- IEL's proposal to test the RCIC and HPCI turbine exhaust return lines to the suppression pool (penetrations N-212, N-214, N-222) with water and to add the results to the air leakage totals for compliance with technical specifications limits is acceptable because this proposal is conservative with regard to the requirements of Appendix J.

- A full containment airlock test at a pressure of Pa once every 6 months is required. IEL's proposal to conduct this testing once every operating cycle is unacceptable.

- Testing of airlock gaskets at a pressure of Pa within 3 days of airlock opening is acceptable.

Proposed Technical Specifications Changes

- Note 2 of Table 3.7-1 regarding the testing of containment airlocks should be changed to read "To be tested at least once every 6 months" in lieu of "To be tested at least each operating cycle."

- The addition of a flange "O"-ring to penetration 213 in Table 3.7-1 is acceptable.

- The deletion of valves V-14-2, V-14-4, V-17-80, V-17-84, and V-22-60 from Table 3.7-2 is acceptable because Appendix J does not require that they be tested. Valves CV-2410, CV-2411, CV-2211, and CV-2212 should not be deleted from Table 3.7-2.

- Deletion of valves MO-1908 and MO-1909 from Table 3.7-2 is acceptable because Appendix J does not require that they be tested. Valves MO-2115, MO-2117, MO-2135, and MO-2137 should not be deleted from Table 3.7-2 unless the Licensee's testing of the core spray system is used to demonstrate a water seal on the isolation valves throughout the post-accident period.

- The deletion from Table 3.7-2 of 10 inaccessible, normally open manual valves in closed systems inside containment is acceptable because only the outside valves are relied upon as containment isolation valves in accordance with GDC 57.

- The deletion of V-17-54, V-17-52, and V-17-53 from Table 3.7-2 is acceptable because the associated penetration is being deleted.

- Testing of valves in the direction opposite the pressure existing in the post-accident condition is acceptable because IEL has determined that leakage results are equivalent to or more conservative than leakage results obtained in the direction of post-accident pressure.

- Several miscellaneous changes were found to be acceptable except for the conversion of water leakage to air leakage for certain valves and airlock testing requirements as described above under Potential Exemptions from Appendix J.

## 5. REFERENCES


1. Mr. Karl Goller, Assistant Director for Operating Reactors
   Letter to Iowa Electric Light and Power Company (IEL)
   August 7, 1975

2. Lee Liu, Vice President, IEL
   Letter to Mr. Karl Goller, Assistant Director for Operating Reactors
   October 13, 1975

3. Lee Liu, IEL
   IEL Application for Amendment of DPR-49 and the Technical Specifications
   to Mr. Harold Denton, Director, Office of Nuclear Reactor Regulation
   August 9, 1978

4. L. O. Root, Assistant Vice President, IEL
   Letter to Mr. T. A. Ippolito, Chief ORB-3
   May 9, 1980