TVA

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SEP 01 1992

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

Gentlemen:

In the Matter of	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
		50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING UNITS 1 AND 3 CONFORMANCE WITH NUREG-0737, ITEM II.E.4.2 AND 10 CFR 50, AP"NDIX J (TAC NOS. M74606, M74615, and M74616)

In response to the request contained in Reference 1, Enclosure 1 contains a comparison between the containment isolation configuration for BFN Units 1 and 3 and the Unit 2 configuration reviewed by NRC as documented in their Safety Evaluation Reports (Reference 2, Enclosure 2, Section 3.2, Reference 3 and Reference 4). In order to minimize the number and scope of updates that will have to be provided to NRC on this issue, Enclosure 1 reflects the anticipated configuration at the time of the restart of Units 1 and 3. The anticipated changes reflect upgrades that were performed on Unit 2 in order to facilitate Appendix J testing and committed modifications for Units 1 and 3, including commitments for the Unit 2 Cycle 6 outage that will be incorporated on Units 1 and 3 prior to their restart.

Enclosure 1 also provides a discussion of other potential isolation sources, the design of containment penetrations, isolation methods, missile protection provisions, and testing of containment penetrations. NRC will be provided with a summary of changes to the Units 1 and 3 containment isolation configuration (e.g., instrument penetrations, valve numbers, and valve types) approximately one hundred and eighty days prior to the restart of each unit.

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In accordance with the Unit 2 precedent, BFN has prepared notebooks that include flow diagrams, penetration tabulations, and other relevant information for each system. These notebooks are available at TVA's Rockville office for review. However, the flow diagrams reflect the current design for Units 1 and 3 and not their anticipated configuration at the time of Units 1 and 3 restart. Therefore, conflicts exist between the anticipated restart configuration provided in Enclosure 1 and the current design information contained in the supporting notebooks.

The differences between Unit 2 and the Units 1 and 3 containment isolation design scheme are minor and are justified in accordance with BFN's licensing and design basis. A summary list of commitments contained in this letter is provided in Enclosure 2. If you have any questions, please contact G. D. Pierce, Interim Manager of Site Licensing, at (205) 729-7566.

Sincerely,

O. J. Zeringue

cc: See page 4

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References: 1) NRC letter to TVA, dated May 5, 1992, Request for Additional Information to Review Browns Ferry Nuclear Plant Units 1 and 3 Compliance with NUREG-0737 Item II.E.4.2 and 10 CFR 50, Appendix J

2) NRC letter to TVA, dated March 22, 1991, Issuance of Amendment and Compliance Review of 10 CFR 50, Appendix J and TMI Item II.E.4.2.1-4

3) NRC letter to TVA, dated May 11, 1992, Safety Evaluation Pertaining to Discrepancies in Previous Safety Evaluation for Amendment 193

4) NRC letter to TVA, dated April 10, 1991, Issuance of Amendment (TS 284)

U.S. Nuclear Regulatory Commission

September 01, 1992

Enclosure
cc (Enclosure):

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ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION

The following is a comparison between the containment isolation configuration for BFN Units 1 and 3 and the Unit 2 configuration reviewed by NRC as documented in their Safety Evaluation Reports (Reference 2, Enclosure 2, Section 3.2 and Reference 3). For each system, a summary of the Unit 2 configuration is provided and differences between Unit 2 and the Units 1 and/or 3 configuration are identified, discussed, and justified. The Unit 2 configuration summary is provided for comparison purposes only; BFN is not proposing any changes or clarifications to the Unit 2 configuration.

MAIN STEAM LINE/DRAIN

For Unit 2, Main Steam Line, Penetration 7A-D, and Main Steam Drain, Penetration 8, are classified as non-essential systems. The Main Steam Lines have two air-operated globe valves on each line, one inside and one outside of containment, that close on a Group 1 isolation signal. They utilize an air supply to open and a spring to close. Upon loss of the air supply, the valves will fail closed. The Main Steam Drain isolation valves are motor operated valves and fail "as is". The power supplies for these valves are separate and diverse. The Main Steam Lines and Main Steam Drains are tested in accordance with Appendix J guidelines.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

DEMINERALIZED WATER

For Unit 2, Demineralized Water, Penetration 20, is classified as a non-essential system. Both containment isolation valves are located outside of containment, with the manual globe valve being the outermost valve and the check valve being the innermost valve. Both valves are tested in accordance with Appendix J. The manual globe isolation valve and a block valve that is used to test the leakage of the check valve are included in the BFN locked valve program.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used.

REACTOR FEEDWATER

For Unit 2, Reactor Feedwater, Penetration 9A and 9B, is classified as a non-essential system. The penetrations have two simple check valves on each line, one inside and one outside containment. Both of the check valves are Appendix J tested. Guidance is provided in normal operating procedures to close the feedwater heater outlet valves, which are located in the Turbine Building, when shutting down the reactor feedwater system. These valves would provide additional assurance of long-term isolation.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used.

AUXILIARY BOILER SYSTEM

For Unit 2, the Auxiliary Boiler System, Penetration 210A, is classified as a non-essential system. Penetration 210A has two simple check valves and a block valve, all located outside containment, as isolation barriers. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used.

CONTROL AIR SYSTEM

For Unit 2, the Control Air System, Penetration 48, is classified as a non-essential system. This system has two air operated plug valves in series, located outside of containment. They utilize an air supply to open and a spring to close. The valves fail closed upon loss of air and receive a Group 6 isolation signal. These valves are Type A and Type C tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

SERVICE AIR SYSTEM

For Unit 2, the Service Air System, Penetration 21, is classified as a non-essential system. Penetration 21 has an inboard check valve and an outboard remote-manually operated globe valve. The outboard globe valve is included in the locked valve program. These valves are Appendix J tested.

For Unit 1, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used. For Unit 3, the containment isolation check valve is located outside containment. This check valve is located inside containment for Units 1 and 2. The same valve types, failure modes, and Appendix J testing methods are used. In cases where two isolation valves are located outside the containment, special attention was given to assure that the piping to the isolation valves has an integrity at least equal to the containment.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

SAMPLING AND WATER QUALITY SYSTEM

For Unit 2, the Sampling and Water Quality System, Penetration 41, is classified as a non-essential system. Penetration 41 has an inboard and outboard air operated globe valve as isolation barriers. They utilize an air supply to open and a spring to close. Upon loss of air supply, the valves will fail closed. These valves also isolate upon receipt of a Group 1 isolation signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

STANDBY LIQUID CONTROL

For Unit 2, the Standby Liquid Control System, Penetration 42, is classified as an essential system. Penetration 42 has a double check valve arrangement, one inside and one outside containment. These valves are Appendix J tested. Downstream of the outboard check valve is an explosive valve that can serve as another isolation barrier until the system is operated.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used.

CONTAINMENT VENTILATION SYSTEM

For Unit 2, the Containment Ventilation System, Penetration 25, is classified as a non-essential system. Penetration 25 has three air operated butterfly valves. These valves isolate upon receipt of a Group 6 isolation signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

RECIRCULATION SYSTEM

For Unit 2, the Recirculation System, Penetrations 37C and 38C, are classified as a non-essential system. Penetrations 37C and 38C have double check valve arrangements as isolation barriers, one inside and one outside containment. These valves are Appendix J tested.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

The recirculation pump seal injection water is provided by the control rod drive (CRD) hydraulic pumps. The CRD pumps are provided with inlet and outlet isolation valves, and a discharge check valve. Downstream of the CRD pumps, the seal water injection lines are provided with a manual seal supply shutoff valve, manual flow control valve, and manual isolation valves before entering the containment penetration. If the CRD pump is operating, seal water supply pressure will prevent back-leakage. Normal operating procedures require the seal injection lines be isolated if the CRD pump is not operating. Normal operating procedures also instruct the operators to close the recirculation pump seal supply shutoff valve and monitor seal pressure to ensure the valve is not leaking. These provisions provide assurance of long-term isolation.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used.

REACTOR WATER CLEANUP SYSTEM

For Unit 2, the Reactor Water Cleanup (RWCU) injection, Penetration 9B, is classified as a non-essential system. Penetration 9B has a double check valve arrangement as an isolation barrier, one inside and one outside containment. These valves are Appendix J tested. A downstream remote-manual isolation valve has been included in the Emergency Operating Instructions (EOIs), which lists the valves that potentially could be used for the isolation of leaks from high energy primary systems into secondary containment.

For the Units 1 and 3 RWCU return to "B" Feedwater, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used. Unit 3 has an additional return to "A" Feedwater check valve (Penetration X-9A) that is similar in configuration to the return to "B" Feedwater line. This additional check valve (3-69-624) is tested in accordance with Appendix J. As discussed later, a similar downstream remote-manual valve could be used for the isolation of leaks from high energy primary systems into secondary containment. The subject of other potential isolation sources is discussed later.

For Unit 2, the Reactor Water Cleanup supply, Penetration 14, is also classified as a non-essential system. It has inboard and outboard motor operated gate valves as containment isolation barriers. These valves isolate on a Group 3 signal and are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used for the RWCU supply.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

REACTOR BUILDING CLOSED COOLING WATER

For Unit 2, the Reactor Building Closed Cooling Water (RBCCW) system, Penetrations 23 and 24, is classified as a non-essential system. Penetration 23, RBCCW return, has an outboard remote-manually operated gate valve. Penetration 24, RBCCW supply, has an outboard check valve. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

REACTOR CORE ISOLATION COOLING SYSTEM

For Unit 2, the Reactor Core Isolation Cooling (RCIC) system, Penetration 9B, is classified as an essential system. Penetration 9B has a testable check valve outside containment as its isolation barrier. This valve is Appendix J tested. A downstream remote-manual valve is included in the EOIs, which lists the valves that potentially could be used for the isolation of leaks from high energy primary systems into secondary containment.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used for RCIC injection.

For Unit 2, RCIC steam supply, Penetration 10, is classified as an essential system. Penetration 10 has an inboard and an outboard motor operated gate valve as containment isolation barriers. These valves isolate upon receipt of a Group 5 signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used for RCIC Steam Supply.

HIGH PRESSURE CORE INJECTION SYSTEM

For Unit 2, the High Pressure Core Injection (HPCI) system injection, Penetration 9A, is classified as an essential system. Penetration 9A has a testable outboard check as an isolation barrier. This valve is Appendix J tested. A downstream remote-manual valve is included in the EOIs, which lists the valves that potentially could be used for the isolation of leaks from high energy primary systems into secondary containment.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, and Appendix J testing methods are used for HPCI.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

For Unit 2, HPCI steam supply, Penetration 11, is also classified as an essential system. Penetration 11 has an inboard and an outboard motor-operated gate valve as a containment isolation barrier. These valves isolate upon receipt of a Group 4 isolation signal. These valves are Appendix J teste

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used for HPCI Steam Supply.

RESIDUAL HEAT REMOVAL SYSTEM

For Unit 2, Residual Heat Removal (RHR) shutdown cooling discharge, Penetrations 13A and 13B, are classified as essential systems. Penetrations 13A and 13B have an inboard testable check valve and an outboard motor-operated gate valve as isolation barriers. The gate valve isolates upon receipt of a Group 2 isolation signal. These valves are Appendix J tested.

For Unit 2, RHR shutdown cooling supply, Penetration 12, is classified as a non-essential system. The penetration has an inboard and outboard motor-operated gate valve as isolation barriers. These valves receive a Group 2 isolation signal. However, the outboard valve is normally closed with power removed to meet the requirements of the Unit 2 Appendix R program. Thus, isolation is maintained by administrative controls during power operation, not by a Group 2 isolation signal.

For Unit 2, RHR recirculation and pump test lines have an existing test valve that will also be designated as part of the containment isolation boundary.

For Units 1 and 3, the same valve types, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used. The same penetrations are used for Unit 3.

CORE SPRAY SYSTEM

For Unit 2, Core Spray Injection, Penetrations 16A and 16B, are classified as an essential system. Penetrations 16A and 16B have inboard testable check valves and outboard remote-manual gate valves as isolation barriers. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

DRYWELL DRAINS

For Unit 2, Drywell Drain, Penetrations 18 and 19, is classified as a non-essential system. Penetrations 18 and 19 have two outboard air operated gate valves as an isolation barrier. These valves close upon receipt of a Group 2 isolation signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

CONTAINMENT INERTING

For Unit 2, Hydrogen sample line, Penetrations 52C, 229D and 229K, are classified as a non-essential system. Penetrations 52C, 229D and 229K have two outboard solenoid operated gate valves as isolation barriers. These valves close upon receipt of a Group 6 isolation signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used for the Hydrogen sample line. However, Unit 1 uses Penetration 52D instead of 52C. The other locations are the same for Units 1 and 3.

For Unit 2, Hydrogen Purge sample line, Penetration 27F, is classified as a non-essential system. Penetration 27F has two outboard solenoid operated gate valves as an isolation barrier. These valves close upon receipt of a Group 6 isolation signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used for the Hydrogen Purge sample line.

For Unit 2, Hydrogen-Oxygen sample return line, Penetrations 229B and 229G, are classified as a non-essential system. Penetrations 229B and 229G have two outboard solenoid operated gate valves as an isolation barrier. These valves close upon receipt of a Group 6 isolation signal. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used for the Hydrogen-Oxygen sample return line. However, Unit 3 uses Penetration 229A instead of Penetration 229B.

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BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

RADIATION MONITORING SYSTEM

For Unit 2, Drywell Continuous Air Monitor suction, Penetrations 50A and 50D, are classified as a non-essential system. Penetrations 50A and 50D have two outboard motor operated ball valves as isolation barriers. These valves close upon receipt of a Group 6 isolation signal and are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

For Unit 2, Drywell Continuous Air Monitor discharge, Penetration 50C, is classified as a non-essential system. Penetration 50C has two outboard motor operated ball valves as isolation barriers. These valves close upon receipt of a Group 6 isolation signal and are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

POST-ACCIDENT SAMPLING SYSTEM

For Unit 2, the Post-Accident Sampling System (PASS) liquid and gas return to torus valves and the PASS Residual Heat Removal liquid sample valves are located outside of containment. These valves receive a Group 6 isolation signal, do not have a specified maximum operating time, are normally closed, and stay closed upon receipt of the isolation signal. The PASS is a non-essential system. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

DRYWELL CONTROL AIR

For Unit 2, the Drywell Control Air (DCA) system has inlet header check valves inside and outside containment. The two DCA check valves do not have a specified maximum operating time, are normally open, and either stay open or closed after an accident depending on the operational status of the process system. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

CONTAINMENT ATMOSPHERIC DILUTION

For Unit 2, Containment Atmosphere Dilution System (CAD), Penetration 25, is classified as an essential system. Penetration 25 has two outboard remote-manually operated solenoid valves and two outboard check valves as an isolation barrier. These valves are Appendix J tested.

For Units 1 and 3, the same valve types, locations, failure modes, isolation schemes, power supplies, and Appendix J testing methods are used.

For Unit 2, the current CAD crosstie to Drywell Control Air has a check valve located outside containment. The current CAD check valve does not have a specified maximum operating time, is normally closed, and will either stay closed or open after an accident depending on the operational status of the process system. TVA is committed to replace the outboard CAD primary containment check valve in each train with a qualified normally closed solenoid valve and a normally closed manual valve, which bypasses the solenoid valve, prior to restart from the next refueling outage. These valves will be Appendix J tested.

For Units 1 and 3, TVA intends to use the same valve types as the final Unit 2 configuration, failure modes, isolation schemes, power supplies, and Appendix J testing methods.

Although not previously reviewed for Unit 2, the following is a description of the containment isolation provisions that will be implemented for all three units for the Hardened Wetwell Vent system. By letter, dated October 30, 1989, TVA committed to implement of the hardened wetwell vent in response to Generic Letter 89-16.

HARDENED WETWELL VENT

For Units 1, 2, and 3. the Hardened Wetwell Vent system is classified as a non-essential system. It will utilize two remote air operated butterfly valves as isolation barriers. These valves do not receive a containment isolation signal and fail closed on loss of air and/or power. There will be two key lock switches per valve. The operator will have to arm the system with one keylock switch and the turn the second keylock switch to energize the solenoid that opens the valve. The valves will be sealed closed barriers under administrative control to assure they cannot be inadvertently opened. These valves will be Appendix J tested.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

OTHER POTENTIAL ISOLATION SOURCES

On July 10 and 11, 1990, TVA and NRC met to discuss primary containment isolation at BFN. As documented in the NRC's August 17, 1990 meeting notes, the staff requested that TVA consider the following recommendation:

> Some systems use two check valves in series as primary containment isolation. Although this arrangement was part of the original design basis, and as such is acceptable, it would not be acceptable if evaluated to the current General Design Criteria. However, most of these systems already have a downstream manual valve that could be identified in the BFN Emergency Operating Instructions (EOIs) (such valves would not require Appendix J testing) as additional assurance for long term isolation.

In TVA's September 17, 1990 response, TVA committed to revise 2-EOI-3, Secondary Containment and Radioactive Releasee Control, to identify the valves which potentially could be used for the isolation of leaks from high energy primary systems into secondary containment. TVA also committed to incorporate similar changes into the Units 1 and 3 EOIs prior to the restart of each unit. The valves listed in the update Unit 2 EOI were compared to the Units 1 and 3 system configurations. Similar Units 1 and 3 valves were identified.

CONTAINMENT ISOLATION DESIGN CRITERIA

Information regarding the design of containment penetrations, isolation methods, missile protection provisions, and testing of containment penetrations is discussed is Section 5.2 of the BFN Final Safety Analysis Report (FSAR). Information explicitly applicable to the NRC's areas of concern have been excerpted and are provided below. The FSAR should be used as a reference for additional information.

Isolation Valves -

The criteria governing isolation valves for the various categories of penetrations are as follows.

a. Pipes or ducts which penetrate the primary containment and which connect to the reactor primary system, or are open to the drywell free air space, are provided with at least two isolation valves in series. Valves in this category are designed to close automatically from selected signals and shall be capable of remote-manual actuation from the control room.

b. The valves are physically separated. On lines connecting to the reactor primary system, one valve is located inside the primary containment and the second outside the primary containment as close to the primary containment wall as practical.

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BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

c. Lines that penetrate the primary containment, and which neither connect to the reactor primary system nor are open into the primary containment, are provided with at least one valve which may be located outside the primary containment. Valves in this category are capable of manual actuation from the control room.

d. Motive power for the valves on process lines which require two valves are physically independent sources to provide a high probability that no single accidental event could interrupt motive power to both closure devices. Loss of valve power to each is detected and annunciated.

e. Steam line isolation valve closure time is such that for any design basis break the coolant loss is restricted so that the core is not uncovered.

f. Valves, sensors, and other automatic devices essential to the isolation of the containment are provided with means to periodically test the functional performance of the equipment. Such tests include demonstration of proper working conditions, correct setpoint of sensors, proper speed of responses, and operability of fail-safe features.

g. The control circuits for the isolation valves are designed so as to prevent the valves from automatically reopening when primary containment isolation logic is reset.

The following are exceptions to the above isolation valve criteria.

a. Automatic isolation valves, in the usual sense, are not used on the inlet lines of the core spray, RHR (LPCI), HPCI, RCIC, and feedwater systems. Operation of the core spray, RHR (LPCI), and HPCI systems is essential following a loss-of-coolant accident. Although not essential, operation of the RCIC and feedwater systems to maintain reactor vessel water level is desirable following a loss-of-coolant accident. Since normal flow of water in these systems is inward to the reactor vessel or primary containment, check valves located in these lines provide automatic isolation when necessary.

b. Automatic isolation valves are not provided on the outlet lines from the pressure suppression chamber to the core spray and RHR pumps. These lines return to the containment and are required to be open during post-accident conditions for operation of these systems.

c. No automatic isolation valves are provided on the Control Rod Drive Hydraulic System lines. These lines are isolated by means of the normally closed hydraulic system control valves located in the Reactor Building, and by means of check valves comprising a part of the drive mechanisms.

d. TIP isolation valves and small diameter instrument lines.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

The main steam lines have air-powered valves. Studies have shown this arrangement to have a high reliability with respect to functional performance.

Influent lines, such as the feedwater lines which connect to the reactor vessel, have one check valve inside and one check valve or motor-operated isolation valve outside the primary containment. An AC operator is chosen for the motor-operated valves, since the motor is simpler in construction and is assessed as having higher overall reliability than a DC motor for the same service. The check valves close automatically by reverse flow through the pipe.

TIP System guide tubes are provided with an isolation valve which closes automatically upon receipt of proper signal and after the TIP cable and fission chamber have been retracted. Manual operator intervention to reset the insertion logic for the TIP system is required in the event a Group 8 isolation signal causes the TIP ball valves to isolate upon withdrawal of the probe. This feature ensures containment integrity is maintained in the event of design basis accident. In series with this isolation valve, an additional, or back-up, isolation shear valve is included. Both valves are located outside the drywell.

The function of the shear valve is to assure integrity of the containment even in the unlikely event that the present isolation valve should fail to close or the chamber drive cable should fail to retract, if it should be extended in the guide tube during the time that containment isolation is required. This valve is designed to shear the cable and seal the guide tube, if necessary, upon a manual actuation signal. Valve position (full open or full closed) of the automatic closing valves is indicated in the control room. Closure of the shear valves will be performed by operator action from the control room. Each shear valve will be operated independently. The valve is an explosive-type valve, DC operated, with monitoring of each actuating circuit provided.

In the event of a containment isolation signal, the TIP System receives a command to retract the traveling probes for the five machines. Upon full retraction, the isolation valves are then closed automatically. If a traveling probe were jammed in the tube run such that it could not be retracted, this information would be supplied to the operator who would, in turn, investigate the situation to determine if the shear valve should be operated.

Lines such as the closed cooling water lines, which neither connect to the reactor primary system nor are open into the primary containment, are provided with at least one AC powered valve located outside the primary containment, or a check valve on the influent line outside the containment. although such valves are not true containment isolation valves.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

Instrumentation piping connecting to the reactor primary system which leaves the primary containment is dead ended at instruments located in the Reactor Building except for the reactor recirculation sample line for the PASS. These lines are provided with manual isolation valves and an excess flow check valve. The reactor recirculation sample line for the PASS is taken from a jet pump instrument line downstream of the flow limiting orifice and excess flow check valve. This small (1/2-inch, schedule 80) line is normally isolated n... the tie-in point on the jet pump instrument line by a remote manual solenoid valve controlled from the main control room. This solenoid valve would only be open during periodic testing of the PASS or during PASS sampling operations, post-accident, when the reactor is at high pressures. For large break LOCA's where reactor vessel pressure may not be sufficient to provide sufficient head to obtain a sample from this tie-in, the PASS connection on the RHR system (see Section 10.21) would be used. Thus, for all practical purposes, this small sample line is dead-ended inside the Reactor Building. Therefore, local leak rate testing of this specific instrument line configuration will not be performed, rather the integrated leak rate test will be used as the confirmation for leak-tightness.

Instrumentation piping, which opens into the drywell and suppression chamber and whose external branches terminate in dead end service and are capable of withstanding drywell design conditions, utilize one locally operated block valve.

The Control Rod Drive Hydraulic System lines are provided with two valves which are utilized for isolation purposes. The first is a ball check valve, which comprises an internal portion of the control rod drive mechanism. The second valve is the normally closed hydraulic system control scram valve located in the control and equipment rooms in the Reactor Building.

The Containment Atmospheric Dilution inlet lines to the drywell and suppression chamber contain a solenoid operated valve and a check valve. Both valves are located outside primary containment.

All isolation valves (except non-testable checks and CAM sampling isolation valves) are provided with limit switches which are used to indicate in the control room that the valves are either open or closed. For the isolation valves in the sampling and sample return lines in the CAM system, the valve position is identified in the control room by indication of energization of the solenoid valves.

All isolation valves (except non-testable check valves) are capable of being actuated from the control room. Primary containment isolation will occur before or at the same time that ECCS initiates.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

Safety Evaluation -

The primary containment and its associated safeguards systems are designed to accomplish four principal functions, namely:

a. To accommodate the transient pressures and temperatures associated with the equipment failures within the containment,

b. To accommodate and mitigate the effects of potential metal-water reaction subsequent to postulated accidents involving loss of coolant,

c. To provide a high integrity barrier against leakage of any fission products associated with these equipment failures, and

d. To provide containment protection against damaging effects of missiles.

These factors are considered in the following evaluation of the integrated Primary Containment System.

Primary Containment Leakage Analysis -

The primary containment for each unit is constructed in such a manner that it can be verified initially that, at the maximum pressure resulting from the design basis accident, the leakage rate is not in excess of 2.0 percent per day of the free volume of the primary containment (La). Two tests were performed. The initial test was performed at a reduced pressure of 25 psig (P_t) to determine the leakage rate (L_{tm}). The second test was performed at 49.6 psig (P_a) to measure the leakage rate (L_{am}). The leakage characteristics yielded by measurements L_{tm} and L_{am} were used to establish the maximum allowable reduced pressure leakage rate (L_t). To verify primary containment integrity throughout the service life of the unit, periodic leakage rate tests will be performed.

Isolation Valves -

One of the basic purposes of the Primary Containment System is to provide a minimum of one protective barrier between the reactor core and the environmental surroundings subsequent to an accident involving failure of the piping components of the reactor primary system. To fulfill its role as an insurance barrier, the primary containment is designed to remain intact before, during, and subsequent to any design basis accident of the process system installed either inside or outside the primary containment. The process system and the primary containment are considered as separate systems, but where process lines penetrate the containment, the penetration design achieves the same integrity as the primary containment structure itself. The process line isolation valves are designed to achieve the containment function inside the process lines when required.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

Since a rupture of a large line penetrating the containment and connecting to the reactor coolant system may be postulated to take place at the containment boundary, the isolation valve for that line is required to be located within the containment. This inboard valve in each line is required to be closed automatically on various indications of reactor coolant loss. A certain degree of additional reliability is added if a second valve, located outboard on the containment and as close as practical to it, is included. This second valve also closes automatically if the inboard valve is normally open during reactor operation. If a failure involves one valve, the second valve is available to function as the containment barrier. By physically separating the two valves, there is less likelihood that a failure of one valve would cause a failure of the second. The two valves in series are provided with independent power sources.

The ability of the steam line penetration and the associated steam line isolation valves to fulfill the containment safety design basis, under several postulated single-failure conditions of the steam line, is shown below by consideration of various assumed steam line break locations.

a. The failure occurs within the drywell upstream of the inner isolation valve. Steam from the reactor is released into the drywell and the resulting sequence is similar to that of a loss-of-coolant accident, except that the pressure transient is l[illegible]re since the blowdown rate is slower. Both isolation valves close upon receipt of the signal indicating low water level in the reactor vessel. This action provides two barriers within the steam pipe passing through the penetration and prevents further flow of steam to the turbine. Thus, when the two isolation valves close subsequent to this postulated failure, containment integrity is attained, and the reactor is effectively isolated from the external environment.

b. The failure occurs within the drywell and renders the inner isolation valve inoperable. Again, the reactor steam will blow down into the primary containment. The outer isolation valve will close upon receipt of the low water level signal, and the reactor becomes isolated within the primary containment, as above.

c. The failure occurs downstream of the inner isolation valve either within the drywell or within the guard pipe.

   Both isolation valves will close upon receipt of a signal indicating low water level in the reactor vessel. The guard pipe is designed to accommodate such a failure without damage to the drywell penetration bellows, and the design of the pipeline supports protects its welded juncture to the drywell vessel. Thus, the reactor vessel is isolated within the primary containment by means of the inner isolation valve, and the primary containment integrity is maintained by closure of the outer isolation valve. It should be noted that this condition provides two barriers between the reactor core and the external environment.

ENCLOSURE 1
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UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

d. The failure occurs outside the primary containment between the outer isolation valve and the turbine.

The steam will blow down directly into the pipe tunnel or the Turbine Building. Steam releases into the tunnel are detected by temperature sensors. When these sensors detect a high temperature condition in the steam tunnel, they initiate main steam isolation. This action isolates the reactor, completes the containment integrity, and places two barriers in series between the reactor core and the outside environment. Pipe supports prevent containment damage.

It should be noted also that the turbine stop valves, located in the steam lines just ahead of the turbine, will provide a backup containment barrier, in addition to the outer isolation valves, for such breaks as a, b, and c as discussed above.

The exceptions to the arrangement of isolation valves described above (1 inboard, 1 outboard), for lines connecting directly to the containment or reactor primary system, are made only in the cases where it leads to a less desirable situation because of required operation or maintenance of the system in which the valves are located. In the cases where, for example, the two isolation valves are located outside the containment, special attention is given to assure that the piping to the isolation valves has an integrity at least equal to the containment.

The TIP system isolation valves are normally closed. When the TIP system cable is inserted, the valve of the selected tube opens automatically and the chamber and cable are inserted. Insertion, calibration, and retraction of the chamber and cable require approximately 5 minutes. Retraction requires a maximum of 1-1/2 minutes. If closure of the valve is required during calibration, the isolation signal causes the cable to be retracted and the valve to close automatically on completion of cable withdrawal. A manually actuated shear valve is also provided in the event the cable cannot be withdrawn. Reinsertion of the TIP probe upon clearing of the Group 8 isolation signal requires manual operator intervention to reset the insertion logic.

It is not necessary, nor desirable, that every isolation valve close simultaneously with a common isolation signal. For example, if a process pipe were to rupture in the drywell, it would be important to close all lines which are open to the drywell, and some effluent process lines. However, under these conditions, it is essential that containment and Core Standby Cooling Systems be operable. For this reason, specific signals are utilized for isolation of the various process and safeguards systems.

ENCLOSURE 1
BROWNS FERRY NUCLEAR PLANT
UNITS 1 AND 3 CONTAINMENT ISOLATION CONFIGURATION
(CONTINUED)

Isolation valves must be closed before significant amounts of fission products are released from the reactor core under design basis accident conditions. Because the amount of radioactive materials in the reactor coolant is small, a sufficient limitation of fission product release will be accomplished if the isolation valves are closed before the coolant drops below the top of the core.

Valves, sensors, and other automatic devices essential to the isolation of the containment are provided with means for periodically testing the functional performance of the equipment. Such tests are necessary to provide reasonable assurance that the containment isolation devices perform as required when called upon to do so.

The test capabilities which are incorporated in the primary containment system to permit leak detection testing of containment isolation valves are separated into two categories. The first category consists of those pipelines which open into the containment and do not terminate in closed loops outside the containment but contain two isolation valves in series.

Test taps are provided between the two valves which permit leakage monitoring of the first valve when the containment is pressurized. The test tap can also be used to pressurize between the two valves to permit leakage testing of both valves simultaneously. The valves, associated sensors, and equipment which will be subjected to containment pressures during the periodic leakage test are designed to withstand containment design pressure without failure or loss of functional performance. The functional performance of these devices has been verified by demonstration either during the leakage tests or subsequent to the test but prior to startup.

The second category consists of those pipelines which connect to the reactor system and contain two isolation valves in series. A leak-off line is provided between the two valves, and a drain line is provided downstream of the outboard valve. This arrangement permits monitoring of leakage on the inboard and outboard valves during reactor system hydrostatic tests, which can be conducted at pressures exceeding the reactor system operating pressure of 1000 psig.

Primary Containment Integrity and Leak Tightness -

Fabrication procedures, nondestructive testing, and sample coupon tests are in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Subsection B. Provisions were made to test the integrity of the primary containment systems during construction phases. These tests included a pneumatic test of the drywell and suppression chamber at 1.25 times their design pressure in accordance with code requirements.

ENCLOSURE 1
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(CONTINUED)

After installation of new penetrations in the drywell and suppression chamber, the vessel will be pressurized to the calculated peak accident pressure and measurements taken to verify that the integrated leakage rate from the vessel does not exceed 2.0 percent per day. Since both the drywell and suppression chamber have the same design pressure, it is possible to test the entire primary containment at the same pressure and without the necessity of providing temporary closures to isolate the suppression chamber from the drywell. Penetrations welded directly to the primary containment are tested with the complete containment vessel. The necessary instrumentation is installed in the containment vessel to provide the data required to calculate and verify the leakage rate. Inspections during these tests, periodic inservice inspections, and tests throughout plant life ensure early detection and repair of any leaks or other deterioration of the primary containment.

ENCLOSURE 2

BROWNS FERRY NUCLEAR PLANT (BFN)

SUMMARY OF COMMITMENTS

TVA will:

- Provide NRC with a summary of changes to the Units 1 and 3 containment isolation configuration approximately one hundred and eighty days prior to the restart of each unit.