SECTION 5.0

CONTAINMENT

5.1 SUMMARY DESCRIPTION

5.1.1 General

The containment system is a "multibarrier" system with:

1. A primary barrier consisting of the primary containment with its pressure suppression system.

2. A secondary barrier consisting of the reactor building with a system to limit the ground level release of airborne radioactive material from the secondary containment.

5.1.2 Primary Containment

The primary containment is an enclosure for the reactor vessel, the reactor coolant recirculation system, and other branch connections of the reactor coolant system. The primary containment includes a drywell and a pressure suppression chamber connected by vents, isolation valves, vacuum breakers, containment cooling systems, and other service equipment. The drywell is a steel pressure vessel in the shape of a light bulb, and the pressure suppression chamber is a torus-shaped steel pressure vessel located below and encircling the drywell.

The primary containment is a seismic Class I structure and is designed to withstand the jet forces resulting from a rupture of a reactor coolant system pipe.

The primary containment has provisions for rendering the containment atmosphere non-flammable by reducing and maintaining the oxygen content to less than 4 percent during normal and accident conditions.

5.1.3 Secondary Containment

The reactor building, in conjunction with the reactor building heating and ventilating system and the standby gas treatment system, constitutes the secondary containment.
The reactor building encloses the primary containment, the refueling and reactor servicing areas, new and spent fuel storage facilities, and other reactor auxiliary systems. The secondary containment serves as the containment during reactor refueling and maintenance operations when the primary containment is open, and

as an additional barrier when the primary containment is functional.

The secondary containment is designed to seismic Class I criteria. It limits the ground level release of airborne radioactive materials and provides for the controlled elevated release of the building atmosphere under accident conditions.

5.2 PRIMARY CONTAINMENT

5.2.1 Safety Objective

The safety objective of the primary containment is to contain the released steam in the event of the design basis LOCA to limit the release to the reactor building of fission products associated with this accident.

5.2.2 Safety Design Basis

1. The primary containment has the capability to withstand the peak transient pressure which occurs due to the postulated LOCA, i.e., an instantaneous circumferential rupture of one of the recirculation lines, by means of rapid steam condensation, and can maintain its functional integrity indefinitely during the design basis LOCA.

2. The primary containment has the capability for rapid isolation of all process lines which penetrate the primary containment.

3. The primary containment, together with the ECCS, shall withstand the effects of metal-water reactions subsequent to the design basis LOCA.

4. The primary containment shall maintain its functional integrity during the maximum credible earthquake.

5. The primary containment is designed so that, under accident conditions, leakage of radioactive material shall not result in off-site doses in excess of the limits specified in 10CFR50.67.

6. The primary containment has the capability to withstand jet forces associated with the flow from the postulated rupture of any pipe within the containment.

7. The primary containment design permits filling the primary containment vessel with water to a level above the reactor core.

8. The primary containment is designed to permit leakage tests.

9. The primary containment has the capability of being purged with nitrogen and maintain containment atmosphere at less than 4 percent oxygen during normal operation. The inerting of containment (oxygen

concentration less than 4 percent) and the control of post accident oxygen sources provides the primary means of controlling combustible gases in containment following a design basis LOCA without the need for post accident venting.

10. The primary containment is designed so that the effects of any potential missiles on the reactor coolant pressure boundary shall not exceed the effects associated with the design basis LOCA.

11. The primary containment is designed so that a single potential missile shall not cause the loss of more than one redundant subsection of a vital safety system or the loss of more than one functionally independent safety system.

12. The primary containment, including its associated torus attached piping, is designed to withstand hydrodynamic loads accompanying safety relief valve discharge to the suppression pool.

13. The primary containment is provided with a hardened (pipe) vent to be used in the event of a long term loss of the RHR cooling of the Torus water. The scenario is beyond the current licensing basis of the plant and is called the TW Sequence as defined by the BWR Owner's Group. The vent is a direct path from primary containment to the atmosphere.

14. The primary containment is provided with a Containment Atmosphere Dilution (CAD) system that provides a capability to purge containment post LOCA with nitrogen. The CAD system is designed to meet the requirements of 10CFR50.44. The use of the CAD system is beyond the current licensing design basis of the plant.

    The combustible gas control system has since been evaluated using experimentally and analytically determined oxygen generation rates, as permitted in Regulatory Guide 1.7. As a result the CAD system has been determined to not be required for design basis LOCA response.

5.2.3 Description

5.2.3.1 General

The primary containment is a pressure suppression system and houses the reactor vessel, the reactor coolant recirculation systems, and other primary system piping. The primary containment system consists of a drywell, a pressure suppression chamber which stores a large volume of water, a connecting vent system between the drywell and the suppression pool, isolation valves, vacuum breakers, containment cooling systems, and other service equipment. The primary containment general arrangement is shown in Figure 5.2.1.

In the event of a primary system piping failure within the drywell, reactor water and steam would be released into the drywell atmosphere. The resulting increased drywell pressure would force a mixture of drywell atmosphere, steam, and water through the vents into the suppression pool, resulting in a pressure reduction in the drywell due to steam condensation.

The primary containment is designed for a maximum internal pressure of 62 psig coincident with a maximum temperature of 281°F. The maximum external pressure is 2 psi above internal pressure. As permitted by the ASME Boiler and Pressure Vessel Code, Section III, Subsection B, the design internal pressure is 56 psig, the design temperature is 281°F and the design external pressure is 2 psi above internal pressure. Stress due to thermal gradients, dead, live, concentrated, internal pressure, and seismic loads are considered in the design.

A detailed description of the load combinations used in the design of the primary containment is included in Appendix M.

Vacuum breakers are provided in the vent headers and located in the suppression chamber, to equalize the pressure between the drywell and the suppression chamber. A vacuum breaker system is also provided between the suppression chamber and secondary containment. Cooling systems are provided to remove heat from the drywell and from the water in the suppression chamber. Appropriate isolation valves are provided to ensure containment of radioactive materials.

The vent system conducts flow from the drywell to the suppression chamber and distributes this flow uniformly in the suppression pool. The suppression pool condenses the steam portion of this flow and the suppression chamber contains the non-condensible gases and fission products. The suppression chamber-to-drywell

vacuum breakers and the suppression chamber-to-secondary containment vacuum breaker system limit the pressure differential so as not to exceed the design limit of 2 psi. The suppression chamber is designed for the same leakage rate as the drywell.

The suppression pool also provides for steam condensation during the actuation of a safety relief valve and the subsequent blowdown through the discharge piping. The response of the suppression chamber to this transient was evaluated as part of the Mark I Containment Program and is discussed in paragraph M.3.5. The dynamic suppression pool loads resulting from a safety relief valve discharge were reduced by installing a sparger (T-quencher) on the discharge end of the safety relief valve piping. The sparger also provides for uniform and stable condensation of steam in the suppression pool. A functional description of the main steam pressure relief system is contained in subsection 4.4.

The primary containment is designed, fabricated, and inspected in compliance with the requirements of ASME Boiler and Pressure Vessel Code, Section III, Subsection B (1965) with all applicable addenda through Summer 1966. The additional quality assurance documentation requirements specified in Appendix IX of ASME Boiler and Pressure Vessel Code, Section III (August 1968), while not applicable, were implemented for the fabrication of the Unit 3 containment vessel where practical.

Plates, forgings, and piping used in the construction of the containment have a maximum initial NDT temperature of 0°F when tested in accordance with the appropriate material specifications. Charpy V-notch specimens were used for impact testing of materials to assure specified properties. The drywell will not be pressurized or subjected to substantial stress at metal temperatures below 30°F.

The design, fabrication, and erection of supports and bracing not within the scope of the indicated ASME codes conform to the requirements of the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, 1963 edition, of the American Institute of Steel Construction (AISC).

The original design parameters of the primary containment pressure suppression system are consistent with experimental data developed for the Bodega Bay pressure suppression containment system for the Pacific Gas and Electric Company at the Moss Landing Test Facility (Reference 1). These original design parameters are summarized in Table M.3.4. Additional design information for the primary containment was developed during the Mark I Containment Long-Term Program. A discussion of the program and applicable references are contained in paragraph M.3.5. Final, revised design

parameters are summarized in Table 5.2.1. Design requirements and features of primary containment system components are described in the following paragraphs.

The release of primary containment gases is controlled to ensure safe and efficient disposal through the stack. A normally closed vent discharge line via the standby gas treatment system is provided for this purpose (paragraph 5.3.3, "Standby Gas Treatment System").

The primary containment is provided with a direct hardened (pipe) vent from the Torus vapor space to the environment to mitigate conditions in which the containment integrity is threatened by an overpressure condition related to the long term loss of decay heat. This sequence is beyond the current licensing basis of the plant and is defined as the TW Sequence by the BWR Owner's Group. This sequence was included in the NRC Generic Letter 89-16 where the NRC recommended the installation of a hardened vent to reduce the vulnerability of Mark I Containments to severe accident challenges.

5.2.3.2 Drywell

The drywell is a light bulb-shaped steel pressure vessel with a spherical lower portion, 67 ft in diameter, and a cylindrical upper portion 38 ft 6 inch in diameter. The overall height is approximately 114 ft.

The drywell is enclosed in reinforced concrete for shielding purposes. Above the drywell foundation, the concrete is separated from the vessel by an air gap of approximately 2 in. To prevent foreign matter from falling into the air gap, polyurethane elastic foam material was used to seal each lift of concrete. A complete inspection of the gap was made prior to pouring each lift. Shielding over the top of the drywell is provided at the refueling floor by a removable, segmented, reinforced concrete shield plug.

Access to the drywell is provided by: (1) the drywell head, which is removed for access to the reactor vessel head; (2) the CRD removal hatch; and (3) two equipment hatches for the removal of major equipment. One equipment hatch includes a double-door airlock for personnel access. Manholes are provided in the drywell head and in the torus. All closures are sealed with double gaskets to facilitate leak testing.

The normal environment in the drywell during plant operation is maintained at a slightly positive pressure and a bulk average ambient temperature of 145°F or lower. Temperature is maintained by recirculating the drywell atmosphere across forced draft air cooling units which are cooled by the drywell chilled water

cooling system. Drywell temperature and pressure are continuously indicated in the main control room.

5.2.3.3 Pressure Suppression Chamber and Vent System

The stiffened pressure suppression chamber is a steel pressure vessel in the shape of a torus. It is located below and encircles the drywell, with a centerline diameter of approximately 111 ft and a cross-sectional diameter of 31 ft. It contains approximately 125,000 cu ft of water and has a gas space volume as indicated in Table 5.2.1. The suppression chamber is supported on braced vertical columns to carry its dead and live loading to the reinforced concrete foundation slab of the reactor building. The columns are provided with base plates that are free to slide over lubrite plates. Saddles with supports exist between each pair of existing columns to provide additional support for the suppression chamber during hydrodynamic loads. Vertical torus uplift is prevented by anchoring the base of each support column to the foundation slab, without restricting horizontal motion. Lateral forces are resisted by four earthquake ties on the bottom of the chamber. Access is provided around the outside of the chamber for inspection and maintenance purposes. The drywell vents are connected to a 4 ft 10 in diameter vent header, in the form of a torus, which is contained within the airspace of the suppression chamber. Projecting downward from the header are 96 downcomer pipes, nominally 24 in in diameter and terminating 4 ft below the design water level of the pool. Downcomer ties exist between each downcomer pair to improve the structural capability of the downcomers, to resist thrust and lateral loads, and to reduce stresses at the downcomer-vent header intersection. The intersection of the downcomer and vent header is stiffened to further reduce relative motion during a blowdown to the suppression pool. Vent header deflectors are located below the header to divert flow away from the header and reduce pool swell impact loads. Vacuum breakers are provided between the suppression chamber and the drywell, and between the suppression chamber and the reactor building.

The vent system outside the torus consists of eight circular vent pipes, each having a diameter of 6 ft 9 in. These vent pipes are connected to the vent header located inside the torus. The vent pipes and vent header have the same temperature and pressure design requirements as the containment. Jet deflectors are provided in the drywell at the entrance of each vent pipe to prevent damage to the vent pipes from jet forces which might accompany a pipe break in the drywell. The pipes are provided with two-ply, testable expansion joints to accommodate differential motion between the drywell and suppression chamber.

The suppression chamber is designed to the same material and code requirements as the steel drywell vessel, and the material has a maximum initial NDT temperature of 0°F.

Pressure suppression pool temperature and pool level are continuously indicated in the main control room.

5.2.3.4 Penetrations

5.2.3.4.1 General

In order to maintain the integrity of containment, containment penetrations have the capability of:

1. Withstanding the peak transient pressure which could occur due to the postulated rupture of any pipe inside the drywell.

2. Withstanding the forces caused by impingement of the fluid from the rupture of the largest local pipe or connection without failure.

3. Accommodating the thermal and mechanical stresses which may be encountered during all modes of operation without failure.

The number and sizes of principal primary containment penetrations and their associated valves are shown in Table 7.3.1.

Primary containment penetration compliance with 10CFR50, Appendix J, "Primary Reactor Containment Leakage Testing For Water Cooled Power Reactors" is shown in Table 5.2.2.

5.2.3.4.2 Pipe Penetrations

Two general types of pipe penetrations are provided: (1) those which must accommodate thermal movement, as illustrated in Figure 5.2.2, and (2) those which experience relatively little thermal stress, as illustrated in Figures 5.2.3 and 5.2.4.

The piping penetrations which accommodate thermal movement are the high temperature lines such as the steam lines, feedwater lines, and other reactor auxiliary system lines. The drywell nozzle passes through the concrete shield and is attached to a bellows expansion joint which, in turn, is attached to a penetration adapter to form a containment pressure boundary. The process line which passes through the penetration is attached to the penetration adapter and is free to move axially. A guard pipe immediately surrounds the process line and is designed to protect the bellows and containment boundary should the process pipe fail

within the penetration. Thermal insulation is installed in the annular space between the guard pipe and the process pipe.

The bellows assembly accommodates the thermal expansion of the process pipe and drywell. The hot process pipe is anchored at the penetration adapter external to the drywell and guided at the other end of the penetration to allow thermal movement of the pipe parallel to the penetration. Two isolation valves are provided, one outside the drywell and the other inside the drywell. These valves are located as close to the drywell penetration as practical.

The bellows expansion joints are of two-ply construction and permit leak testing of these penetrations at pressures up to the primary containment design pressure. The expansion joint assembly is designed, constructed, and tested in accordance with the previously specified requirements for the primary containment (paragraph 5.2.3.1) and code case interpretations, including Code Cases 1177-5 and 1330-1. The bellows are fabricated from stainless steel. Non-destructive tests of the assemblies include radiography and liquid penetrant tests of welds, and pneumatic pressure tests of bellows.

Penetration adapters are one-piece forgings with integral flues made of the same material as the process pipe. The adapters are designed, fabricated, and tested in accordance with the previously specified requirements for the primary containment (paragraph 5.2.3.1).

The design of the penetrations takes into account the simultaneous stresses associated with normal thermal expansion, live and dead loads, seismic loads, and loads associated with a LOCA within the drywell or safety relief valve discharge. For all of these conditions, including combinations of these loads, the resultant stresses in the pipe and penetration components do not exceed the code allowable design limits.

The design takes into account the jet force loading resulting from the failure of the steam piping in addition to the other loadings given. The resultant stresses in the pipe and penetration for this condition do not exceed 90 percent of the yield stresses of the material. The drywell is protected against pipe whipping of the recirculation loops and is also protected at the penetrations to minimize the translation of force to the drywell.

Cold piping and ventilation ducts are welded directly to the drywell penetrations. Bellows and guard pipes are not necessary since the thermal stresses are small and are accounted for in the design of the weld joints.

5.2.3.4.3 Electrical Penetrations

Figure 5.2.5 shows a typical penetration which is used for power, control, and instrumentation circuits. All penetrations are sealed and have provisions for leak testing at design pressure.

5.2.3.4.4 Traversing In-Core Probe Penetrations

Penetrations of the insertion guide tubes through the primary containment are sealed by brazing to the flanged penetration adapters. Since the 1965 edition of the ASME Boiler and Pressure Vessel Code, Section III, does not have provisions for qualifying the brazing procedures or performance, these seals are made in accordance with the requirements of Section VIII of this code.

5.2.3.4.5 Personnel and Equipment Access Locks

Two 12-ft diameter equipment hatches are provided for the drywell. These hatches have bolted heads with double seals to allow testing. Combined with one equipment hatch is a personnel airlock having two 2 ft 6 in by 6-ft gasketed doors in series. The doors are designed and constructed to withstand the drywell design pressure. The doors are mechanically interlocked so at least one door is closed at all times when containment is required. The locking mechanisms are designed so that a tight seal will be maintained when the doors are subjected to either internal or external pressures. The seals on the doors are capable of being tested by pressurizing the air lock. A special device locks the inner door against unseating pressure when the airlock is pressurized for test without pressurizing the primary containment.

A bolted personnel access hatch on the drywell head and a bolted closure head for the CRD removal hatch are provided with testable double seals.

The personnel and equipment locks are designed as cantilever appendages on the drywell. For method of analysis and strength criteria used, refer to FSAR subsection M.3. The seismic design was performed using static coefficients and checked dynamically.

An air gap is provided between the steel shell and the concrete to account for differential expansion between them. The airlock is not embedded in concrete so there is no interaction between the concrete and the lock.

5.2.3.4.6 Access to the Pressure Suppression Chamber

Access to the pressure suppression chamber from the reactor building is provided at two locations. The entrances have testable, double-sealed, bolted covers.

5.2.3.4.7 Access for Refueling Operations

The drywell vessel head is removed during refueling operations. The head is held in place by bolts and is provided with testable double seals.

5.2.3.5 Isolation Valves

The general criteria governing the installation and operation of isolation valves for the various categories of penetrations are as follows:

1. Pipes or ducts which penetrate the primary containment and which connect to the reactor primary system, or are open to the drywell free gas space, generally are provided with at least two isolation valves in series.

   Valves in this category are designed to close automatically and are capable of remote manual actuation from the main control room (except check valves).

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

2. Lines which penetrate the primary containment and which neither connect to the reactor primary system nor which open into the primary containment, are provided with at least one valve located outside the primary containment.

3. Power sources for the valves on process lines which require two valves are physically independent 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.

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

5. Containment isolation valves will not reopen automatically when the logic for the isolation signal is reset. The reopening of containment isolation valves requires deliberate operator action.

The following lines are exceptions to the previously stated isolation valve criteria:

1. Automatic isolation valves are not used on the inlet lines of the core spray and CAD systems, since operation of these systems is essential following a LOCA. These lines can be isolated, if required, using remote manual isolation valves. Since normal flow in these systems is inward to the reactor vessel or primary containment, check valves located in these lines provide automatic isolation when necessary.

   Automatic isolation valves are not provided on the outlet lines from the pressure suppression chamber to the pumps of the ECCS and RCIC. These lines return to the containment and are required to be open during post-accident conditions for operation of these systems. These valves are attached to lines which are an extension of the containment and are enclosed in a pump room adjacent to the containment which has provisions for environmental control of any fluid leakage. These lines from the suppression pool are water sealed so no containment atmosphere can impinge upon the valves. In these instances, the water seal acts as the inboard barrier and the first valve serves as the primary containment isolation valve.

2. Automatic isolation valves are not provided on the individual CRD hydraulic system lines. These lines are isolated by the normally closed hydraulic system control valves located in the reactor building, by check valves comprising a part of the drive mechanisms, and by isolation valves on the scram discharge volume.

3. TIP isolation valves and small diameter instrument lines.

4. The isolation valves on the Reactor Building Closed Cooling Water System and The Drywell Chilled Water System do not receive automatic isolation signals, since the continued use of these systems will tend to mitigate the consequences of an accident. In addition, 10CFR 50, Appendix A, GDC 57 allows the use of a remote-manual valve on lines such as these that are neither part of the reactor coolant pressure boundary

nor connected directly to the containment atmosphere. Plant operating procedures ensure appropriate closure of these valves following the onset of an accident.

5. Automatic isolation valves are not provided on the SLC system inlet line. The SLC system discharges into the reactor vessel, and utilizes a check valve outside containment and explosive valves outside containment prior to SLC system initiation for containment isolation. After the SLC system actuates, the check valve provides isolation when necessary, along with a water seal on the inboard side of the containment penetration such that no containment atmosphere can travel outside containment.

Table 7.3.1 is a listing of principal primary containment penetrations and associated isolation valves.

Influent lines, such as the feedwater lines, which connect to the reactor vessel or which open into the primary containment have one check valve inside and one check valve or motor-operated isolation valve outside the primary containment.

TIPS guide tubes are provided with an isolation valve which closes automatically upon receipt of a containment isolation signal after the TIP cable and sensor have been retracted. In series with the isolation valve, an additional, or backup, isolation shear valve is included. Both valves are located outside the drywell. In the event of a containment isolation signal, the TIPs receives a command to retract the traversing probes for the several machines. Upon full retraction, the isolation valves are closed automatically. If a traversing probe 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. The function of the shear valve is to assure integrity of the containment even in the unlikely event that the isolation valve should fail to close, or the chamber drive cable should fail to retract if it were 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 an actuation signal. Valve position (full open or full closed) of the automatic closing valves is indicated in the main control room. Closing of the shear valves is performed by operator action from the main control room. Each shear valve is operated independently. The valve is an explosive-type valve, dc-operated, with monitoring of each actuating circuit provided.

Lines, such as the closed cooling water lines, which neither connect to the reactor primary system nor 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 inside the containment.

Instrumentation piping, connecting to the reactor primary system, which leaves the primary containment is dead-ended at instruments located in the reactor building. These instrument sensing lines are stainless steel seismic Class I piping. The lines vary in size from 1-1/2” to 1/4” and have a wall thickness of schedule 40S or 80S. A 1/4-inch restricting orifice is installed in each of these lines, except the instrument lines penetrating N-26A, N-26B, N-28F, and N-29E (Unit 2), N-29F (Unit 3) inside the primary containment as close to the reactor vessel as practical. A 1/4-inch restricting orifice is installed in lines penetrating N-26A, N-26B, N-28F, and N-29E (Unit 2), N-29F (Unit 3) inside the primary containment as close as possible to the containment penetration. The orifice size is selected on the basis of minimum coolant release consistent with minimum effect on instrument response. A manually operated stop valve and an excess flow check valve are installed in each line outside as close as practicable to the primary containment penetration.

Table 7.3.1 indicates those isolation valves which can be actuated from the control room and which valves have their position indicated in the main control room.

A line failure downstream of the excess flow check valve would result in line isolation. A postulated failure between the containment penetration and excess flow check valve would result in a calculated maximum leakage rate of 15.8 gpm, which is well within the normal makeup capability to the reactor coolant system.

The amount of steam released to the reactor building would not result in a failure of secondary containment. The standby gas treatment system, including filters, is designed for 100 percent humidity of the atmosphere, and therefore will experience no degradation of functional performance when initiated.

An analysis of the potential off-site exposure that would result from a 15.8 gpm leak into the reactor building has been performed. Such a leak rate corresponds to the postulated complete failure of an instrument line outside the primary containment but upstream of the excess flow check valve.

The assumptions employed in this analysis were:

1. An instrument line failure results in an initial blowdown of 2.2 lbm/sec of reactor water into the secondary containment.

2. This blowdown continues undiminished with no corrective action taken for a period of 30 min.

3. After a period of 30 min, the reactor is shut down and cooled at a controlled 100°F/hr (3.33 hr).

4. The water which flashes to steam is considered as a rooftop release until the reactor has been depressurized.

5. The I-131 concentration in the blowdown is 1.7×10^{-1} µCi/cc and the total iodine concentration is 6.17×10^{-1} µCi/cc equivalent I-131.

6. The X/Q for ground level release based on wind condition of Pasquill F, 1 m/sec wind speed, and with building wake dilution, is 4.48×10^{-4} sec/cu m.

7. The breathing rate is 3.47×10^{-4} cu m/sec.

Based on these assumptions, the total dose at the site boundary was computed to be 0.31 Rem(1) to the thyroid, which is substantially below the guidelines of 10CFR100.

Note: (1) Due to Power Rerate, this value was conservatively increased to 0.31 Rem based on a ratio of the reactor thermal power increase. Actual calculated value is less. The TPO Uprate of 101.62% takes advantage of the rerate analysis at 102% as a bounding analysis. The change in licensed thermal power from 4016 MWt (TPO uprate) to current licensed power (3951 MWt) was accomplished without changing reactor pressure. Consequently, there was no change in the driving pressure across the orifice (line break) and thus, there was no change in leakage associated with the power increase to the current rated power of 4016 MWt.

Table M.2.1 and Figure M.2.3 indicate the containment penetrations for the sensing lines. The 12-in drywell penetration sleeve contains six equally spaced instrument lines. The manual isolation valves are 1-in stainless steel, 1,500-lb globe valves and are located as close to the penetration as practical consistent with the need for access to the valve. The excess flow check valves close automatically on flow in excess of 3 gpm. The excess flow check valves are equipped with position-indicating switches (open and closed) which energize position-indicating lights at local stations and an annunciator in the main control room. Regular monitoring of measured variables and comparison between redundant instruments, together with the position indication, provides operating personnel with sufficient

information to identify malfunctioning or inoperative instruments and sensing lines. Operating and/or testing procedures will assure the operability of the safety-related instrument lines and their associated orifices and excess flow check valves.

The excess flow check valves can be reset or back-flushed using a manually operated bypass on each valve.

5.2.3.6 Primary Containment Venting and Vacuum Relief System

The primary containment is designed for an external pressure of 2 psi greater than the internal pressure. The primary containment can be vented through ventilation purge connections which are normally closed. Automatic vacuum relief devices are used to prevent excessive negative pressure in primary containment. Vacuum in the suppression chamber is relieved by two valves in series in each of two lines between the suppression chamber and the reactor building. One valve in each line is air operated and is opened when a differential pressure switch de-energizes a dc solenoid valve to release air from the air operator. This valve fails open upon loss of air supply and may be opened from the control room. The other valve in each line is a self-operating vacuum breaker similar to a simple check valve.

Vacuum in the drywell is relieved by 12 valves between the drywell and the suppression chamber. These valves are self-actuating vacuum breakers similar to simple check valves and may be opened by auxiliary air actuators operable at local control stations external to containment for testing purposes. These vacuum breakers are sized on the basis of the Bodega Bay pressure suppression system tests(1). The vacuum breaker flow area is proportional to the flow area of the vents connecting the drywell and suppression pool. The vacuum breakers prevent excessive water level variation in the vent discharge lines. The vacuum breaker capacity selected on this test basis is more than adequate to limit the pressure differential between the suppression chamber and drywell during post-accident drywell cooling operations to the suppression system design value.

The primary containment has been provided with a hardened (pipe) vent from the Torus vapor space to the atmosphere. This vent is designed to respond to an overpressure condition that is beyond the current plant licensing basis. This overpressure condition is the result of the long term loss of decay heat sequence (TW Sequence) as defined in the BWR Owner's Group criteria issued on 3/30/90.

The vent is sized to exhaust sufficient steam to prevent the containment pressure from exceeding the primary containment

pressure limit (PCPL) of 60 psig with a constant heat input equal to 1% of the rated thermal power (4016 MWt).

The direct hardened vent from the Torus bypasses the Standby Gas Treatment System. The hardened vent is a 16" line that is installed between the primary containment isolation valves AO-2(3)511 and AO-2(3)512. A 16" butterfly valve AO-8(9)0290 and a 16" rupture disc are installed in the vent line.

The valve serves as a primary containment outboard isolation barrier while the rupture disc precludes the occurrence of secondary containment bypass leakage. The rupture disc has a burst pressure of 30 psig, which is above the maximum calculated pressure that could result from leakage through the valve.

5.2.3.7 Primary Containment Cooling and Ventilation System

5.2.3.7.1 Design Criteria

The criteria used in the design of the primary containment atmosphere cooling system requires that the cooling equipment be sized such that during normal operation maximum space temperatures and humidity are not to be excessive. The design basis temperature is a bulk average maximum of 145°F with a latent heat removal capability of 0.5 gpm moisture from air. The fan equipment has been tested and complies with the minimum test requirements of the Air Moving and Conditioning Association (AMCA). The cooling coil capacity is based upon coil tests.

5.2.3.7.2 System Description

The primary containment (drywell) cooling system utilizes seven fan-coil units distributed inside the drywell (Drawing M-390). Each fan-coil unit consists of two full-capacity cooling coils and two full-capacity directly connected motor-driven fans (Figure 10.11.1). Each cooling coil is separately connected to the supply and return headers. The normal supply to the headers is chilled water and the backup supply is reactor building cooling water. Provisions are made outside of the drywell to align either chilled water or reactor building cooling water to the supply and return headers.

Each unit circulates the drywell atmosphere through the cooling coils to maintain the drywell space bulk average temperature at 145°F or lower.

Each fan-coil unit is manually controlled from the main control room. The two fans in a fan-coil unit may be run individually or simultaneously. General area temperatures and the inlet and

outlet temperatures of the fan-coil units are indicated in the control room. Fan discharge high temperature annunciates in the control room.

Controls are provided for automatic start of the standby unit if the normal operating unit fails. In the event of a power failure, the chilled water system normally serving the coolers shuts down and the primary containment cooling load is transferred to the reactor building closed cooling water system which is powered from the standby ac power supply.

Four 15-hp fans and their associated ductwork are located within the drywell to equalize the temperature throughout the drywell by recirculating the air at the top of the structure. These fans, as well as the unit coolers, trip automatically in the event of a LOCA. A bypass trip circuit is provided to manually restart the unit cooler fans from the control room to reduce drywell pressure and temperature after a LOCA. This design feature exists although the heat sink, emergency service water (ESW), for the reactor building closed cooling water (RBCCW) system has been eliminated as a result of locking closed the ESW-RBCCW cross-tie valves. Therefore, little, if any, cooling would be provided to the drywell during a loss of off-site power. The bypass is removed automatically if the trip signal returns to normal or electrical power to the bypass circuit is interrupted.

The drywell purge ventilation supply system consists of two full-capacity fans used to supply filtered and tempered outdoor air to the drywell for purge and ventilation purposes, to allow personnel access and occupancy during reactor shutdown and refueling. Whenever required, the purge exhaust air is discharged through the standby gas treatment system for cleanup prior to release to the atmosphere through the off-gas stack.

Each ventilation line connecting to the primary containment is provided with two fast-acting, spring-loaded, cylinder-operated, butterfly valves in series for isolation.

These valves are normally closed during plant power operation and are located outside the primary containment. They are open for inerting/deinerting in accordance with PBAPS Technical Specifications. The valves incorporate a travel stop feature. A travel stop bar is attached to the valve push rod and is restrained by stud nuts. These stud nuts are welded to the studs to prevent tampering of the stroke limit settings. A debris screen is provided on the end of each ventilation line inside the primary containment. These debris screens serve to prevent the entrainment of debris into the ventilation lines which could hinder closure and/or sealing of the butterfly valves.

5.2.3.8 Containment Atmosphere Control System

5.2.3.8.1 Safety Objective:

Following a LOCA, hydrogen (H_2) could be generated within the primary containment from high temperature zirconium fuel cladding and water reaction, other metal water reactions, and from radiolytic decomposition of water. Oxygen (O_2) can be generated from radiolytic decomposition of water, or as a result of external sources of oxygen. The purpose of the containment inerting system is to assure that the initial concentration of O_2 prior to the LOCA is maintained below the flammability limits (5%) within primary containment. This is done by maintaining the primary containment atmosphere inert with nitrogen and ensuring that no external sources of oxygen are introduced into containment as part of normal and post accident operation.

5.2.3.8.2 Safety Design Bases

Containment inerting is an initial assumption of the event analysis. In accordance with Reference 7 as reviewed and approved through Reference 12, initial Containment inerting along with the following design bases requirements ensure there is no need to vent primary containment post accident:

a. The plant Technical Specifications require that when the containment is required to be inerted, the containment atmosphere be less than four percent oxygen;

b. The plant has only nitrogen or recycled containment atmosphere for use in all pneumatic control systems within containment; and

c. There are no potential sources of oxygen in containment other than that resulting from radiolysis of the reactor coolant.

5.2.3.8.3 Identification and Physical Arrangement

During each startup, the primary containment is purged of air with pure nitrogen until the atmosphere contains less than 4 percent oxygen. The containment inerting system is used during the initial purging of the primary containment and provides a supply of makeup nitrogen. The system consists of a liquid nitrogen storage tank; a water-bath vaporizer; ambient vaporizers; an electric heater; pressure-reducing valves and controller; instrumentation; valves; and piping.

An inert atmosphere with less than 4 percent oxygen prevents the combustion of hydrogen, which may be formed during an accident. The P&ID for the inerting system appears in Drawing M-367, Sheets 1 through 3, "Containment Atmospheric Control System."

Nitrogen for inerting is supplied from the common on-site storage tank through the common water-bath vaporizer, where the liquid nitrogen is converted to the gaseous state by heating with auxiliary steam. The gaseous nitrogen then flows through the pressure reducing valves and flow element into the containment pressure suppression chamber and drywell, where it mixes with the air. A safety valve in the nitrogen supply system prevents over-pressurization of the containment. Temperature switches in the flow path provide signals to close control valves and annunciate in the control room, should a vaporizer failure cause cold nitrogen to be emitted from the vaporizer.

The drywell purge supply fans are operated during the purge operation to increase mixing of the nitrogen and air. Gases purged from the containment are vented through the Standby Gas Treatment System (SGTS). Purging continues until the oxygen content of the containment atmosphere is less than 4 volume percent as measured by the containment monitoring system. This takes approximately 9 hours and requires approximately five containment atmosphere volumetric changes. All 6 and 18 inch purge and exhaust isolation valves are limited to a maximum opening position in order to assure that they would close if a LOCA were to occur during purging operations. The maximum opening positions for these valves are shown in Table 7.3.1, Note 17. **Although the valves are designed to close against DBA conditions, a LOCA concurrent with purging operations is no longer required to be evaluated after the implementation of Alternate Source Term. This change to the licensing basis requirements was approved based on the limitation that a purge or vent flow path can only be open for 90 hours per calendar year, and that containment purge as a combustible gas or pressure control measure is not required within 30 days following a DBA LOCA.**

Purging performed during the operational modes of startup, power operation, and hot shutdown for the purpose of inerting or deinerting the primary containment is restricted as follows:

a. Subsequent to placing the reactor in the run mode, inerting must be completed within 24 hours after reactor thermal power is >15%.

b. Deinerting may be initiated no more than 24 hours prior to reducing reactor thermal power to <15% prior to a shutdown.

c. The 6 inch or 18 inch primary containment purge valves and 18 inch primary containment exhaust valves are only permitted to be opened for inerting, de-inerting,

pressure control, ALARA or air quality considerations for personnel entry, or Technical Specification surveillances that require the valves to be open.

d. Only one of the two SGTS trains is used whenever purging primary containment.

e. Both SGTS trains are determined to be operable whenever the purging system is in use.

The inerting system is also utilized to supply makeup gas and vent, as required to maintain an inert atmosphere and control containment pressure during normal operation. This is done by using the same common on-site storage tank, supplying liquid nitrogen to the ambient vaporizers and electric heater to be converted to the gaseous state. The gaseous nitrogen then flows to the common pressure reducing valves and through the same penetration flow path as the inerting flow, into primary containment.

Redundant containment monitoring systems are provided to continuously monitor the containment for hydrogen and oxygen concentration. The analyzers perform both the non-safety related CAC and safety related CAD analysis functions. (See section 5.2.3.9.4 for a description of the CAD operation.) Each monitoring system consists of an analyzer station located in the reactor building and remote control unit located in the control room, which are electrically connected to form a single functional system. The analyzer station contains only that equipment required to withdraw, measure, and return samples of the containment atmosphere. The remote control unit houses a microprocessor based data handling system for controlling the analyzer station equipment. Each analyzer station is arranged to operate in conjunction with the primary containment airborne radioactivity monitoring system during CAC operation. Only one analyzer station will operate in conjunction with the containment airborne radioactivity monitoring system at any time.

Each analyzer station is provided with dedicated sample withdrawal lines so that both analyzer stations can take samples from either the drywell or torus. Each analyzer station can sample the gases from only one point at a time. Gases from the sample point selected are drawn through the analyzer station hydrogen and oxygen sensors by one of two redundant diaphragm type pumps. The analyzer pump also draws gases through the radioactive gas sampler process line in parallel. The sample is routed back to the drywell through the analyzer return lines. The hydrogen and oxygen concentration is indicated at the remote control unit, and supplied as input to the plant monitoring system. Annunciation is provided in the control room for high hydrogen concentration, high

oxygen concentration, and containment monitoring system malfunction.

The hydrogen and oxygen sensors are electrochemical devices that generate an electrical current directly proportional to the partial pressure of the reactive gas in the sample stream. By the proper choice of electrode materials and electrolyte, the electrochemical cell is designed to be highly selective for hydrogen or oxygen and not dependent upon or affected by other gaseous constituents in the sample. The hydrogen sensor has a range of 0% to 30% (by volume) and the oxygen sensor is a dual range device capable of measuring the ranges of 0% to 10% and 0% to 30% (by volume).

5.2.3.9 Containment Atmospheric Dilution System

As a result of NRC approval of TS Amendment 274/278 dated 1/28/10, the NRC concluded that:

> The design purpose of the CAD system is to maintain combustible gas concentrations within the primary containment at or below the flammability limits following a postulated LOCA by diluting hydrogen and oxygen with the addition of nitrogen. The CAD system, however, is considered ineffective at mitigating hydrogen releases from the more risk significant beyond design-basis accidents that could threaten primary containment integrity. The revised 10CFR50.44 rule requires that systems and measures be in place to reduce the risks associated with combustible gases from beyond design-basis accident and eliminate requirements for maintaining hydrogen and oxygen control equipment associated with a design-basis LOCA. As a result, the CAD system is no longer a mitigating safety system required to be maintained per the revised 10CFR50.44 rule and existing TS for this system and can therefore be deleted. However, 10CFR50.44 does require that all primary containments have the capability for ensuring a mixed atmosphere.

5.2.3.9.1 Safety Objective

In accordance with Reference 12, a “safety grade” atmosphere dilution (CAD) system shall be maintained and designed to conform with the general requirements of criteria 41, 42, and 43 of Appendix A of 10 CFR Part 50 and installed in accordance with 10CFR50.44.

As stated in reference 12, the primary means of hydrogen control for Peach Bottom is containment inerting and control of external sources of oxygen. Therefore, the operation of the CAD system and its potential contribution to offsite dose is not assumed in the plant accident analysis described in UFSAR Chapter 14. As

described in Section 5.2.3.9.2 and required by Reference 12, the CAD system is designed to comply with the requirements of 10CFR50.44. Reference 12, states that although the system is no longer assumed to be the primary means of combustible gas control, the system will be maintained as originally installed. This statement requires that the CAD system be maintained as originally designed, but eliminates the need to reevaluate the system's design for design changes that have no impact on the original CAD system design basis. Specifically, the CAD system shall be designed to meet the requirements of 10CFR50.44 and criteria 41, 42, and 43 of Appendix A of 10 CFR Part 50 based on the original plant design.

Although the CAD system design allows operation in ether repressurization mode or purge mode, the purge mode is the only operational mode allowed by the Peach Bottom Transient Response Implementation Procedure (TRIPs). This operating philosophy is consistent with the recommendations of the Emergency Procedure Guidelines (EPGs), Revision 4 which was reviewed and approved by the NRC through Reference 13. The purge mode of operation has been determined through an evaluation to allow the Emergency Response Organization (ERO), the most effective operational means to minimize the consequences of an event with beyond design basis oxygen generation rate. This conclusion is based on the following:

a. Based on realistic evaluation of potential sources of oxygen generation rates in excess of those assumed in NEDO 22155, the purge mode provides the most effective means to minimize the dose release to the public,

b. The repressurization mode, although it provides a dose benefit by delaying and allowing the decay of fission products to minimize dose releases, could result in a more severe accident for the primary containment and limit the capability of the ERO to effectively manage the event, and

c. The TRIPs direct a staged and controlled purge evolution that ensures the completing risks from the accumulation of combustible gases in primary containment, dose to the public and failure of primary containment are effectively managed.

5.2.3.9.2 Safety Design Bases

In accordance with 10CFR50.44 and criteria 41,42, and 43 of Appendix A of 10 CFR Part 50, the original safety design bases are:

1. To prevent the occurrence of oxygen concentrations in excess of 5%, using the conservative radiolytic source bases given in Table 1 of Reference 15.

2. To permit venting of primary containment to prevent the pressure in primary containment from exceeding 30 psig. The 30 psig is a design requirement of 10CFR50.44 that limits the CAD system repressurization of primary containment to 50 percent of the containment design pressure.

3. To limit the off-site dose at the site boundary due to containment venting to less than 30 Rem to the thyroid and 2.5 Rem whole body and ensure the CAD system contribution to the LOCA dose does not exceed the limits of 10CFR100.

4. To provide reliability such that failure of any single component, other than the liquid nitrogen storage tank and its associated instruments, does not prevent the system from accomplishing safety design bases 1, 2, and 3.

5. To provide nitrogen supply to a permanent Safety Grade Instrument Gas (SGIG) system. Following a DBA-LOCA coincident with a loss of instrument air, the SGIG system supplies pressurized nitrogen gas as a backup pneumatic source to the Containment Atmospheric Control (CAC) purge and vent isolation valves, torus to secondary containment vacuum breakers and the Containment Atmospheric Dilution (CAD) vent control valves.

It should be noted that the consideration of oxygen generation rates based on additional experimental evidence and analyses, as permitted in Regulatory Guide 1.7 and documented in References 7 and 12, results in no requirement for CAD repressurization, or containment venting for combustible gas control. However, the NRC in Reference 12, required that this system be retained as originally designed.

5.2.3.9.3 Identification and Physical Arrangement

The CADS is a standby system which serves no safety function during the normal operation of the plant. Following a beyond design basis LOCA, the CADS is used instead of the normal nitrogen inerting system to maintain the oxygen concentration within the containment at less than 5 volume percent. Thus, while the hydrogen generated following a LOCA as a result of metal-water reaction and radiolytic decomposition of water may exceed the 4 volume percent limit of Regulatory Guide 1.7, controlling the oxygen concentration at less than 5 volume percent fully satisfies the requirements of the regulatory guide.

Maintaining an inert atmosphere with a low oxygen concentration prevents burning or explosion, regardless of the amount of hydrogen available, as shown in Figure 5.2.8[(2)].

The CADS for Peach Bottom Units 2 and 3 is shown in Drawing M-372, Sheets 1 and 2.

The on-site supply of nitrogen is liquid; one tank being used to supply both units. The supply tank is located outside of the reactor building and is of seismic Class I design. The supply system is able to deliver gas to the containment at the CADS design pressure. The on-site supply is sufficient to provide at least 7 days of dilution for each unit. This is based on the assumptions concerning H_2 and O_2 generation and concentrations based on Regulatory Guide 1.7. During this period, arrangements can be made to provide replenishment of the nitrogen supply should it be required. The normal inerting makeup system serves as a possible backup source to the CADS nitrogen supply. The only CADS equipment shared between the two units is the on-site storage tank and its associated components.

The nitrogen storage tank is of double wall design and meets the requirements of National Fire Protection Association, and applicable Interstate Commerce Commission, state, and local regulatory requirements.

The nitrogen storage system has redundant electrical vaporizers each of which is capable of supplying up to 100 scfm of gaseous nitrogen at about 150 psig to the CADS. A pressure controlling device is provided to control the pressure at the input of the CADS supply piping.

The supply system consists of a redundant means of reducing the pressure from about 150 psig down to system operating pressure of about 50 psig and of separate supply piping to route nitrogen from the discharge of the pressure-reducing valve to the containment isolation valves, flow indication instrumentation, and flow control devices.

Two pipes are routed to each unit. Each of the two pipes to a particular unit divides to supply nitrogen to both the drywell and suppression chamber. The intent of this arrangement is to provide redundant nitrogen supplies to both the drywell and suppression chamber to satisfy the single failure criteria. The CAD nitrogen supply piping is connected to the drywell and suppression chamber RHR containment spray spargers on the containment side of the inboard isolation valves. Immediately upstream of this connection there are locked open manual globe valve(s), a check valve, and two valves each of which are remotely operated from the main control room. The flow measuring devices are located in each of the two supply pipes. The flow is compensated for pressure and

temperature and calibrated to indicate in units of scf. The flow control valves are designed to be capable of controlling the nitrogen addition rate at about 60 scfm with a pressure differential across the valve varying from 20 to 50 psid.

The containment venting system is shown in Drawing M-372, Sheets 1 and 2. Two pre-existing containment venting systems were utilized; one to vent from the drywell and the other to vent from the suppression chamber. In serving the function of limiting the containment pressure to less than 30 psig, these two containment vents are adequate as differential pressure between the drywell and suppression chamber is not significant. Venting would be done through the 2-in line to the inlet plenum of the standby gas treatment system. The air-operated valves are controlled from the main control room and the pressure control valves intended to limit downstream pressure to about 1 psig.

All piping and valves in the CADS are designed to withstand the full pressure of the stored nitrogen supply and the maximum credible earthquake without loss of function and meet the requirements of ANSI B31.1. Since all carbon steel piping in the system is one (1) inch and because the pipe will normally contain pure nitrogen, no corrosion allowance is required.

The electrical power supply to all required components of this system are from the emergency buses. The electrical design conforms to the applicable portions of IEEE-279-1971 and IEEE-308-1971.

The SGIG system is a Q-listed, seismically-mounted, permanent hard-piped, low-volume backup pressurized nitrogen gas supply to the Containment Atmospheric Control (CAC) vent and purge isolation valves, torus-to-secondary containment vacuum breaker valves, and the CAD vent control valves which are normally supplied with instrument air for their operation. The SGIG system has been installed to replace the local safety grade backup pneumatic (i.e., N_2 -bottles) supply to these normally air-operated valves following a DBA-LOCA coincident with a loss of instrument air. Upgrades have been implemented to the system to comply with the requirements of I. E. Bulletin 79-01B and Regulatory Guide 1.97, Rev. 3.

The SGIG comes from a tie-in to the 6,000 gallons CAD liquid nitrogen tank vapor space or the outlet of the CAD system's electric vaporizers.

Prior to a LOCA, the SGIG supply is taken off the CAD tank vapor space. Following a LOCA, the SGIG flowpath ties-in between PCV-6529 and PCV-6528 after the pressure building coil. The second flowpath requires manual operator action when the CAD liquid

nitrogen system is operating. In this second mode, the CAD liquid vaporizers are operating. A tie-in to this system is connected before the branch for PCV-6521A and PCV-6521B. The two Q-listed flowpaths are connected and go through a pressure reducing station, into the secondary containment. Only one valve in this valve station (consisting of PCVs 7651A and B) is in service at any time. Relief valves downstream of the PCV protect the SGIG from overpressurization. The PCVs reduce the gas pressure to less than 100 psig. The SGIG/instrument air interface is isolated by two safety grade check valves to preclude depressurization of the valve actuator on loss of instrument air. Each component serviced by the SGIG system retains its overpressure protection.

The CAD tank liquid nitrogen level has been set to account for the post-LOCA nitrogen makeup rate for the containment (both drywell and torus), the most limiting condition for use of the SGIG system and possible system leakage.

5.2.3.9.4 Containment Atmospheric Dilution System Instrumentation and Control

The CADS is a manually controlled system. Operator action is required to add nitrogen and to vent containment gas. Redundant containment monitoring systems are provided to monitor the containment for hydrogen and oxygen concentration. The analyzers perform both the safety related CAD and non-safety CAC analysis functions. (See section 5.2.3.8 for a description of the CAC operation.) The hydrogen and oxygen sensors are electrochemical devices that generate an electrical current proportional to the partial pressure of the reactive gas in the sample stream. By the proper choice of electrode materials and electrolyte, the electrochemical cell is designed to be highly selective for hydrogen or oxygen and not dependent upon or affected by other gaseous constituents in the sample. The hydrogen sensor has a range of 0% to 30% (by volume) and the oxygen sensor is a dual range device capable to measuring the ranges of 0% to 10% and 0% to 30% (by volume). Hydrogen and oxygen concentration are indicated, recorded, and alarmed in the control room, and supplied as input to the plant monitoring system and safety plant display system. After receipt of a LOCA signal, the operator is required to start up the containment monitoring system for continuous post-accident tracking.

The sample time response of the instruments is adequate to allow the operator time to act. The response time for the instruments is estimated to be 5 min. The earliest time for nitrogen addition to begin is about 1 day (for initial O_2 concentration after inerting of approximately 4 percent). Consequently, the sample time is a negligible factor in determining the dilution requirements. Depending on the actual generation rates of O_2 and

H_2, the operator will maximize nitrogen flow rate for dilution and will control containment pressure by venting.

The isolation valves in the vent lines which are controlled by switches in the control room, automatically close in the event of an accident signal and fail closed on a loss of air or electrical power. With a primary containment isolation signal present, the isolation signal can be overridden by a key locked bypass switch. The bypass switch arrangement is such that Torus or Drywell vent isolation can be bypassed but not both vent paths thus preventing simultaneously venting of Torus and Drywell. A control room alarm indicates that an isolation signal has been bypassed on one of these lines.

A signal initiated from temperature elements in each of the flow paths will close each of the outboard system isolation valves and annunciate in the control room should a vaporizer failure cause cold nitrogen to be emitted from the vaporizer.

As shown in Drawing M-372, Sheets 1 and 2, the only action required to operate the CAD system's N_2 makeup to the drywell and torus, following a LOCA, is to open the two solenoid valves in each of the lines to the drywell and torus, and set the desired flow rate.

There are two CADS control panels in the control room which contain the control switches for the remotely operated valves and the instrumentation for the system.

The containment remote operated isolation valves are normally closed and fail closed on loss of electrical power. The flow control valves use the nitrogen gas from the CAD liquid nitrogen storage tank for their motive power. They fail open on loss of nitrogen pressure or electrical power to permit adding N_2 to the containment using manual flow control.

The control and instrumentation equipment of the CADS is assigned to two divisions to assure operability in the event of a failure. Each division contains all the equipment necessary to meet the design requirements of the CADS. Each division includes that portion of the system required to inject nitrogen into either the drywell or the torus; the instrumentation necessary to monitor pressure, O_2 and H_2 concentrations in the drywell and the torus; and the equipment necessary to vent gas from the containment at a controlled rate through the standby gas treatment system. There are two venting systems, one for the drywell and one for the torus. One of these is included in each of the two divisions. In addition, a single radioactive gas monitor is included to monitor the radioactive content of the containment atmosphere. This monitor can be operated in conjunction with the CAC/CAD analyzer

in either the CAD or CAC mode of operation. Section 4.10.3.2 contains details of this system.

Electrical power for the components is supplied by the emergency diesel-generators and the 125-V dc batteries.

Each of the divisions is powered from different diesel-generators and batteries. All equipment for one division is physically separated from the other division. Within each division, the containment isolation valves are assigned to two physically separated channels to assure that the dual functions of containment isolation and CADS operation are operable even in the event of a single failure. The containment vent lines are divisionalized such that both valves in the drywell vent lines are supplied from one division, and both valves in the torus vent line are supplied from the other division. Thus, in the event of a single failure, the capability to vent the containment is maintained.

SGIG System

For the SGIG system the following instrumentation have been added:

i) A pressure switch to monitor CAD liquid nitrogen tank pressure and provide an annunciator alarm in the main control room on low-pressure condition. This pressure switch is seismically-qualified quality assured for pipe boundary integrity only.

ii) A temperature switch to monitor nitrogen gas temperature and alarm in the main control room on low-temperature condition. The only portion of the switch which is safety related is the thermowell.

iii) A pressure switch meeting Regulatory Guide 1.97, Category 2 Design and Qualification Requirements, is installed on each SGIG system header to monitor header pressure and provide annunciator alarms in the main control room on low-pressure condition.

iv) A second pressure switch is installed on each SGIG header to provide high-pressure alarm in the main control room when header pressure exceeds 100 psig due to failure of the pressure regulating valves.

5.2.3.9.5 Description

The following descriptions are separated into two sections. The first section describes the Design Basis LOCA assumptions for combustible gas generation and control based on NEDO 22155. The

second section describes the beyond design bases LOCA assumptions for combustible gas generation and control based on Regulatory Guideline 1.7 generation rates.

Design Basis:

The oxygen concentration in the primary containment will be maintained at less than 4 volume percent during normal operation. No difficulty is expected in maintaining oxygen below this level.

Figure 5.2.11 presents the licensing design basis concentration of oxygen in the drywell and suppression chamber based on a radiolytic oxygen generation of 0.1 molecules/100eV as stated in Reference 7. Shown are the resultant maximum expected oxygen concentrations as a function of time, using parameter values that are conservative, but more realistic than those specified in Regulatory Guide 1.7.

From Figure 5.2.11 it is shown that oxygen concentration will not reach the combustible gas limits of 5% until well over 100 days after the initiation of the Design Basis LOCA. Therefore, containment venting will not be required. It should be noted, that Peach Bottom TRIPs would require venting the containment and purging with nitrogen to control hydrogen concentration prior to reaching the combustible gas limits. This venting, however, is only allowed if the releases would not exceed the limits of the Offsite Dose Calculation Manual limits (10CFR20), which are the controls in place for normal operation.

Beyond Design Basis:

The following is a discussion of the beyond design basis description of combustible gas control. The CAD system operation described is based on the original design of the CAD system in the repressurization mode, as stated previously, this mode of operation is stated to define the design basis for the system. The system is no longer operated in this mode. Also the monitoring instrumentation is described in this section. The description of the monitoring instrumentation is equally applicable to the Design Basis discussion.

Figure 5.2.12 and 5.2.13 delineate the concentration for hydrogen and oxygen in the drywell and suppression chamber on a radiolytic oxygen generation of 0.25 molecules/100eV as per Regulatory Guide 1.7. This combustible gas generation rate provides a design input criteria for the sizing of the CAD system.

Excluding that oxygen attributable to radiolytic decomposition of water, the only other post-LOCA oxygen source is that oxygen entrained in the coolant. Based on the design maximum expected

concentration of 0.28 cc/liter (0.4 ppm) of O_2 in 13,000 cu ft of reactor water at 1,000 psi, even if all of the O_2 in the coolant were released to the containment, the total increase in O_2 concentration would be less than 0.1 percent. Containment isolation valves and pneumatic valves within the containment are operated by the instrument N_2 system and do not contribute O_2 to the containment atmosphere. Since the containment and torus will be slightly pressurized normally, and the pressure will remain "positive" after LOCA, there will not be containment in-leakage.

The hydrogen generation from the metal-water reaction is assumed to occur over the first 2 min following the LOCA as per Regulatory Guide 1.7. The hydrogen concentration increases very rapidly above the 4 percent limit due to the large metal-water reaction assumed to occur. Therefore, flammability is dependent upon when the oxygen concentration reaches 5 volume percent. The initial 4 volume percent oxygen concentration drops off immediately due to the large additions of steam from the reactor and hydrogen from the metal-water reaction following the accident. The oxygen concentration gradually increases as the steam is condensed and as radiolysis adds oxygen to the containment.

The nitrogen dilution system does not require special mixing provisions (or systems). The nitrogen dilution concept is based on maintaining the oxygen concentration below the Regulatory Guide No. 1.7 limit of 5 percent. Thus, the only concern from a mixing viewpoint is the potential degree of non-uniformity in oxygen concentration that would occur in the containment. There are three mixing forces existing in the containment after a LOCA; they are diffusion, natural convection, and forced convection. Of these three, the most dominant mixing force would be forced convection. Forced convection would be induced by such things as containment sprays, flow out of the broken pipe, flow through the drywell vent pipes and vacuum relief lines, and the drywell fan coolers, if available. Forced convection is, however, the most difficult mixing force to quantitatively evaluate and detailed calculations of its effects on concentration gradients have not been done.

Detailed calculations have, however, been done on the other two mixing forces, i.e., diffusion and natural convection. The details of this analysis were presented in Amendment 2 to the Duane Arnold Energy Center FSAR in response to question G1.1(d). These calculations showed that the maximum oxygen concentration deviation would be 2 percent from the average at the surface of the suppression pool using conservative assumptions relative to the natural convection driving force. Less conservative assumptions for natural convection would result in a maximum concentration deviation of 0.3 percent. In other words, given an average oxygen concentration of 5 percent, the maximum

concentration at the suppression pool surface would be 5.10 percent, or, less conservatively, 5.015 percent. Based on the results of this analysis, it has been concluded that the assumption of a uniform oxygen concentration in the containment is reasonable for performing analyses related to the nitrogen addition operation.

Redundant containment monitoring systems are provided to monitor the containment for hydrogen and oxygen concentration during post -LOCA operation as shown in Drawing M-372. The analyzers perform both the safety related CAD and non-safety related CAC analysis functions. (See section 5.2.3.8 for a description of the CAC operation.) The Safety Guide No. 7 assumptions concerning the H_2 generation rate from a metal-water reaction are extremely conservative. Consequently, an indication of the H_2 concentration is required to determine whether or not the flammability limit for H_2 is exceeded and the nitrogen addition system is required to control the O_2 concentration.

Each monitoring system consists of an analyzer station located in the reactor building and a remote control unit located in the control room, which are electrically connected to form a single functional system. The analyzer station contains only that equipment required to withdraw, measure, and exhaust samples of the containment atmosphere. The remote control unit houses a microprocessor based data handling system for controlling the analyzer station equipment. The monitoring system is designed to withstand the maximum credible earthquake without loss of function.

Each analyzer station is provided with dedicated sample lines as shown in Drawing M-372 so that both analyzers can take samples from either the drywell or the torus. During CAD operation, one analyzer will normally monitor the drywell and the other analyzer will normally monitor the torus. If a system failure were to occur, the remaining independent system would be toggled between the drywell and torus by the operator. The sample is drawn from the selected sample line through the hydrogen and oxygen sensors by one of two redundant diaphragm type pumps and returned to containment via the non-selected sample line. The sample lines are switched between suction and return modes by 3-way solenoid valves which are automatically controlled by the analyzer. The hydrogen and oxygen concentration are indicated at the remote control unit, displayed on strip chart recorders in the control room, and supplied as input to the plant monitoring system and the safety parameter display system. Annunciation is provided in the control room for high hydrogen concentration, high oxygen concentration, and containment monitoring system malfunction.

It should be noted that the following calculation and description of CAD system operation is provided to demonstrate the CAD system compliance with 10CFR50.44 based on Regulatory Guideline 1.7, Table 1 oxygen generation rates. As previously stated, CAD system operation has been determined by Reference 7 and 12 to not be required and therefore, is not assumed in the licensing basis analysis of the LOCA event. The calculation and description demonstrate that CAD system if utilized as originally designed to comply with the original licensing design basis requirements, would meet the design requirements specified in 10CFR50.44.

$V_n = V_i \left(\frac{C_i}{C_f} - 1\right)$ Following a LOCA, the hydrogen and oxygen analyzers are manually placed in the CAD mode of operation. Hydrogen and oxygen concentrations and pressures in the drywell and torus are recorded. Calculations are made of the production rates of hydrogen and oxygen in each of these volumes. Nitrogen additions are made periodically as needed to keep the hydrogen and oxygen concentrations below the flammability limit. Additions are made one at a time to the drywell and the torus through manual operation of the inlet valves. The amount of nitrogen to be added is determined by the simple calculation:

$$V_n = V_i \left(\frac{C_i}{C_f} - 1\right)$$

where:

V_n = volume of nitrogen to be added, scf

V_i = volume of gas in drywell or suppression chamber before nitrogen addition, scf

C_i = initial concentration of oxygen or hydrogen

C_f = desired final concentration of oxygen or hydrogen

On the basis of Regulatory Guide 1.7 assumptions, as reflected in Figures 5.2.12 and 5.2.13, approximately 1 day will elapse before nitrogen addition system initiation is required. Figure 5.2.14 conservatively shows the maximum total nitrogen requirement as a function of time.

If the oxygen production rate approach that assumed in Regulatory Guide 1.7, the containment pressure will increase and may reach the predetermined limit of 30 psig. As a function of time the resultant containment pressure (psig) for the most restrictive pressurization case (no containment leakage) is provided in Figure 5.2.15. Containment venting will commence in order to prevent containment pressure from exceeding 30 psig. Gas releases will be

made from separate drywell and suppression chamber 2-in venting lines, and will be made when meteorological conditions are most favorable for dose minimization as determined by wind speed and direction instrumentation in the main control room. The releases are controlled by cycling the vent line air operated isolation valves. The duration of the release is analytically determined based on containment pressure and temperature. Based on Regulatory Guide 1.7 assumptions and no containment leakage, the containment pressure will reach 30 psig in approximately 15 days after the LOCA. Gas will be released intermittently until the desired volume has been released. Releases are continued until the containment pressure has been reduced to atmospheric. Approximately 14,400 scf will be released daily. Nitrogen addition will be continued in order to maintain the oxygen or hydrogen concentrations as explained above.

The total off-site dose at the low population zone outer boundary resulting from venting will be about 26 Rem for thyroid dose and about 0.1 Rem whole body dose. (Note: Not applicable to current AST Dose Analysis.)

The vented gas will consist of O_2, H_2, N_2, and steam. The fission product inventory available for release is identical to that used as the basis for the LOCA radiological consequences analysis presented in Subsection 14.9, and is based on source terms provided by TID-14844.

Analyses completed by the BWR Owners Group and Northeast Utilities Service Company indicate that the Regulatory Guide 1.7 radiolytic source terms are extremely conservative. The results of analyses submitted to the NRC in references 7), 8) and 9) indicate that net radiolytic oxygen generation will cease when boiling of the coolant is terminated and CAD system pressurization or venting will not be required for post-LOCA combustible gas control.

The containment system is designed to withstand an internal pressure of 56 psig with less than 0.7 percent volume/day leakage under the LOCA conditions. Since the concept of nitrogen addition involves the repressurization of the containment system, the components, including valves and penetrations, have been reviewed for the capability to withstand long-term pressurization under conditions associated with the design basis accident-LOCA and have been determined to be fully adequate for such service.

The potential for hydrogen stratification in the secondary containment compartments as a consequence of leakage from primary containment has been considered. This potential has been judged to be of such low probability of occurrence that no additional equipment is necessary. The standby gas treatment system and expected building in-leakage, plus unit coolers in the engineered

safeguards compartments will adequately ensure plant safety from such a remote hazard.

5.2.4 Safety Evaluation

5.2.4.1 General

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

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

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

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

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

These factors are considered in the following evaluation of the integrated primary containment system.

5.2.4.2 Primary Containment Characteristics During Reactor Blowdown

In order to establish a design basis for the pressure suppression containment with regard to pressure rating and steam condensing capability, the maximum rupture size of the reactor primary system must be defined. For this design, an instantaneous, circumferential rupture of one recirculation line, or equivalent failure of other equipment in the drywell has been selected as a basis for determining the maximum gross drywell pressure and the condensing capability of the pressure suppression system. The selection of an equipment failure of this size for the design basis is entirely arbitrary, since it is considered that circumferential failure of a recirculation pipe or reactor vessel failure of this magnitude is of such low probability as to be considered incredible. Nevertheless, for design purposes these failure conditions have been selected to establish the containment parameters, but the failure modes and the magnitude of failures are assessed as being incredible.

The design pressure is established on the basis of the Bodega Bay pressure suppression tests[1]. The design pressure is primarily a

function of the postulated rupture area, the drywell to suppression chamber vent area and configuration, vent submergence below the water level in the suppression pool, and the final equilibrium pressure in the pressure suppression chamber.

In establishing the containment design, circumferential pipe ruptures are assumed with sufficient distance separation to allow full potential flow from each end of the pipe. Line flow restrictions are not considered in establishing rupture flow rates.

The containment design parameters listed in Table 5.2.1 are concerned primarily with the effects on the primary containment caused by the blowdown immediately following the postulated double-ended rupture of the recirculation piping or equivalent failure.

The parameters having the greatest effect on drywell design pressure are the ratio of pipe break area to total vent area, the vent submergence below the water level in the suppression pool, initial system pressure, and the equilibrium pressure in the pressure suppression chamber before the postulated rupture.

Sufficient water is provided in the suppression pool to accommodate the initial energy which can transiently be released into the drywell from the postulated pipe failure. The suppression chamber is sized to contain this water, plus the water displaced from the reactor primary system together with the gas initially contained in the drywell.

The difference in the key parameters between the Peach Bottom pressure suppression containment and the Bodega Bay test facility is either in the conservative direction or results in second order effects on the peak pressure leading to the conclusion that the design results in significantly lower pressure peaks at Peach Bottom than those measured at Bodega Bay.

The primary containment response analysis to the design basis LOCA is presented in Section 14.0, "Plant Safety Analysis."

5.2.4.2.1 Primary Containment Characteristics During Reactor Blowdown - Mark I Containment Program Re-Evaluation

A comprehensive reevaluation of the primary containment response to a design basis LOCA was performed during the years 1975-1982 as part of the Mark I Containment Program.

The major effort of the program was to identify the dynamic pool loads to which the suppression chamber would be subjected during a design basis accident. Methods for determining the magnitude of

the dynamic loads were developed during the program and used to reevaluate the structural capacity of the primary containment.

A detailed description of the program is contained in Appendix M and references 3 and 4.

5.2.4.3 Primary Containment Characteristics after Reactor Blowdown

5.2.4.3.1 General

During the blowdown of the primary coolant into the drywell immediately following the recirculation line break, the temperature of the suppression chamber water reaches 159°F at 10 minutes. The maximum primary containment system pressure is 48.7 psig, as discussed in Reference 20, and illustrated in Figure 14.6.10. The peak drywell pressure remains below the drywell design pressure. The peak drywell airspace temperature exceeds the drywell shell design value for only a short time (less than 20 seconds). This short duration of the drywell temperature excursion above the design value is not expected to present a threat to the drywell structural materials due to the long time that it takes for the drywell wall to heat up. This evaluation includes operation with 90°F Feedwater Temperature Reduction. This evaluation includes operation with 90°F Feedwater Temperature Reduction. The peak drywell temperature is bounded by the original temperature used for qualification of PBAPS equipment located in the drywell. Most of the non-condensable gases would be transported to the suppression chamber during the blowdown. However, drywell and torus pressures will be equalized via the vacuum breaker system.

The core spray system removes the residual heat from the core, thereby minimizing core heatup and any metal-water reaction. The heat would be removed from the reactor vessel through the broken recirculation line in the form of hot liquid. This hot liquid would combine with liquid from the drywell spray, if operated, and flow into the suppression chamber via the drywell to suppression chamber connecting vents. Steam flow would be negligible. The energy transported to the suppression chamber water would be removed from the primary containment system by the RHR heat exchangers in the containment cooling mode.

In order to assess the primary containment response after the blowdown and to demonstrate the adequacy and redundancy of the core and containment spray cooling systems, an analysis has been made of the recirculation line break under various conditions of core and primary containment cooling.

The long-term pressure and temperature response of the primary containment has been analyzed for various design basis accidents and special events. The long-term analyses are directed primarily at the suppression pool temperature response, considering the decay heat addition to the suppression pool. The DBA LOCA, small steam line break (SSLB), LOCAs, and loss of RHR normal shutdown cooling (NSDC) function event and shutdown of the non-accident unit were all analyzed for 102% of licensed thermal power (4030 MWt). Special events such as station blackout, Appendix R and ATWS were analyzed at 100% of licensed thermal power (4016 MWt). The impact of local suppression pool temperatures during SRV discharges was also addressed in accordance with the NUREG-0783 (Ref. 21) criteria.

5.2.4.3.2 Minimum Containment Pressure Available

Prior to Extended Power Uprate (EPU), the analysis of Net Positive Suction Head (NPSH) for ECCS pumps taking suction from the Suppression Pool relied on some amount of containment accident pressure at elevated Suppression Pool temperatures. A separate analysis determined the Minimum Containment Pressure Available (MCPA) following a LOCA, to ensure the MCPA bounded the Containment Overpressure Required (COPR) for NPSH margin.

Currently the NPSH analysis for ECCS pumps is performed without any credit for containment accident pressure. Thus, the MCPA analysis is no longer required. Modifications, including the addition of RHR cross-tie lines to enable the alignment of the two RHR heat exchangers for increased containment cooling capability, result in reduced Suppression Pool temperatures, which increases the NPSH-available to ECCS pumps.

5.2.4.3.3 Deleted

5.2.4.4 Primary Containment Capability

The pressure of the primary containment system depends on both the system temperatures and the amount of non-condensible gases. Thus, the capability of the system to house resulting gases from metal-water reaction varies with the rate and extent of the reaction.

Capability is defined as the maximum percent of fuel channels and fuel cladding material which can enter into a metal-water reaction during a specified duration without the design pressure of the containment structure being exceeded. The analysis of the postulated LOCA discussed in Section 14.0, "Plant Safety Analysis," shows that the operation of either of the two core spray system loops will maintain continuity of core cooling such that the extent of the resultant metal-water reaction would be 0.1

percent or less. However, to evaluate the containment system design capability, various percentages of metal-water reaction were assumed to take place over various durations of time. This analysis presents an arbitrary method of measuring system capability without requiring prediction of the detailed events in a particular accident condition. The results are presented in Section 14.0, "Plant Safety Analysis."

5.2.4.5 Primary Containment Leakage Analysis

The primary containment was tested to verify that the initial leakage rate was not in excess of 0.7 percent per day by weight of air in the primary containment at the calculated peak accident pressure. The testing and analysis was done in accordance with Bechtel Topical Report BN-TOP-1, Revision 1, "Testing Criteria for Integrated Leakage Rate Testing and Primary Containment Structures for Nuclear Power Plants."

For the purposes of evaluating containment leakage in accident analysis, it was assumed that the primary containment had a leakage rate of 0.7 percent per day. For accident analysis purposes, this procedure is conservative since the containment is designed to preclude leakage greater than 0.7 percent per day at the containment design pressure of 56 psig. The primary containment leakage assumptions used in the accident analysis are presented in Section 14.9.2.

5.2.4.6 Containment Integrity Protection

The primary containment is designed to withstand the effects of jet forces (steam/water impingement or reaction) resulting from a longitudinal split or circumferential break of a pipe. The access lock, doors, and electrical and piping penetrations are either designed to resist the jet forces or provided with a jet deflector.

For penetration integrity, all large pipes which penetrate the containment and connect to the primary system are provided with anchors or limit stops near the containment wall. The penetration anchors or limit stops are designed to withstand the jet forces associated with the break of the pipe.

The vent discharge downcomers are designed to withstand the jet reaction forces caused by flow discharge into the suppression pool.

The primary containment is protected from missiles generated either internally or externally in the following manner:

1. Potential missiles inside the primary containment are not a threat to containment since they do not have sufficient energy. Even so, potential missiles that are not a threat to the containment, such as valve stems, small flanges, small valve bonnets, thermowells, and other small items of instrumentation, are also oriented to direct the path of travel away from the containment. In addition, special care is taken in component arrangements to ensure that equipment associated with the engineered safeguards systems are segregated so that failure of one system cannot cause the failure of the other systems, or that failure of any component which would bring about the need for these engineered safeguards systems does not render the safeguard system inoperable.

   The missile penetration formulas are as follows:

   Concrete - Modified Petry (as described in reference 5).

   Steel - Stanford (as described in reference 6).

2. Outside the primary containment, the surrounding reinforced concrete provides a barrier against external missiles.

The concrete shield plug is capable of resisting missiles generated in a tornado. The probability of a high-trajectory, turbine-generated missile landing on the reinforced concrete shield plug above the drywell is very remote, on the order of 10^{-12} per year. Operating and accident thermal loads on the plug were evaluated and they are within the allowable stresses when considered in combination with other loadings. No detrimental effect will occur.

The drywell is protected against whipping of the recirculation loops and is also protected at the penetrations to minimize the translation of force to the drywell. The recirculation primary coolant pipe loops are restrained to prevent damage to the primary containment. The physical separation that exists between the redundant emergency core cooling systems provides adequate spatial separation to preclude concurrent damage to more than one of these systems by a single postulated pipe failure. Based upon the conservative piping design utilizing proven engineering design practice, the proper choice of piping materials, and the use of conservative quality control standards and procedures of piping fabrication and installation, it is concluded that other lines will not break in such a manner as to bring about significant

movement of these pipes. Further discussion on this topic may be found in paragraph M.3.2.4.5.1.

5.2.4.7 Penetrations

Penetrations through the primary containment are anchored in the containment wall to resist forces to which the line may be subjected. They are designed to withstand the moments resulting from a pipe rupture inside the drywell. Leaktight integrity is provided by welding penetration nozzles to the containment shell. Penetrations are designed, fabricated, and inspected in compliance with previously described requirements of the primary containment (paragraph 5.2.3.1).

Piping penetrations which accommodate thermal movements are provided with bellows protected by a guard pipe as described in paragraph 5.2.3.4.2.

Debris screens surround the containment purge and vent penetrations to capture debris which could potentially become entrained in the escaping air following a LOCA.

A personnel access lock is provided with interlocked double doors to ensure that containment integrity is effective while access is being made.

Access hatches are sealed in place, using flexible double seals to ensure leaktightness. These openings are closed at all times when containment is required.

Inspection and surveillance provide additional ensurance of integrity and functional performance of the penetrations. For this reason, provisions are made to leak test expansion bellows, electrical penetrations, the personnel access lock, and the access hatches. This can be accomplished without pressurizing the entire containment system.

5.2.4.8 Isolation Valves

Since rupture of a large line penetrating the containment and connecting to the reactor coolant system may be postulated to take place outside the containment boundary, isolation valves are provided. Both valves in each line are closed automatically on various indications of reactor coolant loss. Additional reliability is added by the second valve, located outboard of, and as close as practical to, the containment wall.

Once closed, the containment isolation valves will not reopen automatically when the logic for the isolation signal is reset.

To reopen the containment isolation valves, deliberate operator action is required.

If failure involves one valve, the second valve is available to function as the containment barrier. Independent power sources to the two valves provide assurance that no single accidental event could interrupt motive power to both closure devices.

It is neither 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 cooling systems be operable. For this reason, specific signals are used to isolate the various process and safeguards systems.

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, limitation of fission product release is sufficient if the isolation valves are closed before the onset of the Gap Release phase (2 minutes per Reference 22), and the valves are so designed.

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

The ability of the main steam line penetrations and the associated steam line isolation valves to fulfill the containment objectives under several postulated single failure conditions of the steam line is shown below by consideration of various assumed main steam line break locations (refer to Section 14.0, "Plant Safety Analysis").

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 LOCA, except that the pressure transient is less severe since the blowdown rate is slower. Both isolation valves close upon receipt of a signal indicating either high steam flow or low water level in the reactor vessel. This action provides a barrier within the primary containment and prevents further flow of steam to the turbine. Thus, when the isolation valves close

subsequent to this postulated failure, containment is isolated and the reactor is effectively isolated.

b. The failure occurs within the drywell and renders the inner isolation valve inoperable:

Again, the reactor steam blows down into the primary containment. The outer isolation valve closes upon receipt of a signal indicating either high steam flow or low reactor water level, and the containment is isolated.

c. The failure occurs downstream of the inner isolation valve within the drywell:

Both isolation valves close upon receipt of a signal indicating either high temperature, high steam flow, or low reactor water level.

Thus, the reactor vessel is isolated within the primary containment by the inner isolation valve, and the primary containment is isolated by closure of the outer isolation valve.

d. The failure occurs outside the primary containment upstream of the outer isolation valve:

The steam blows into the pipe tunnel until the inner isolation valve is automatically closed. Closure of the inner isolation valve places a barrier between the reactor core and the external environment. This barrier serves to isolate the reactor and the containment.

e. The failure occurs outside the primary containment and renders the outer isolation valve inoperative:

Automatic closure of the inner isolation valve achieves the containment barrier and isolates the reactor.

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

The steam blows down directly into the pipe tunnel or the turbine building until the isolation valves automatically close. This action isolates the reactor and the containment.

The off-site consequences of the Main Steam Line Break are represented in the accident analysis given in Subsections 14.4 and 14.9.

5.2.5 Inspection and Testing

The following surveillance and testing are conducted on the various systems or components of the primary containment during construction or plant operation.

5.2.5.1 Primary Containment Integrity and Leaktightness

Fabrication procedures and non-destructive testing are in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Subsection B (1965 edition). Provisions were made to test the integrity of the primary containment system during construction phases and prior to startup of the plant.

A pneumatic test of the drywell and suppression chamber at 1.25 times the design pressure of 56 psig, in accordance with code requirements, was conducted after construction of the containment vessel was completed.

After complete installation of all penetrations in the drywell and suppression chamber prior to startup of the plant, the vessel is pressurized to the calculated peak accident pressure and measurements taken to verify that the integrated leakage rate from the vessel does not exceed 0.7 percent by weight per day. A second test was run at reduced pressure to establish a relationship between leakage rate and containment pressure. Since both the drywell and suppression chamber have the same design pressure, it is possible to test the entire primary containment at the same time and without the necessity of providing temporary closures to isolate the suppression chamber from the drywell. However, additional testing over the life of the plant will be conducted in accordance with Technical Specification requirements to determine the amount, if any, of containment bypass leakage existing between the drywell and torus. Essentially this test involves drywell pressurization with measurement of pressure rise in the torus. This method of testing is capable of detecting the limiting bypass area equivalent to a 1-inch diameter hole.

Further discussion on inspection and testing may be found in Appendix I, "In-service Inspection," Technical Specifications, and Table 5.2.2.

5.2.5.2 Penetrations

With the exception of the pipe penetrations which are welded directly to the primary containment shell, it is possible to leak test individual containment penetrations without pressurizing the entire containment system.

Pipe penetrations which must accommodate thermal movements, including drywell to torus vents, are provided with two-ply bellows expansion joints. Each ply of the bellows is designed for the containment design pressure, and can be checked for leaktightness by pressurizing the space between the two plies of the bellows.

Electrical penetrations are provided with double seals and are separately testable. The test taps and the seals are located so that tests of the electrical penetrations can be conducted without entering or pressurizing the drywell or suppression chamber.

All containment closures are fitted with resilient seals or gaskets and are separately testable to verify leaktightness. The covers on flanged closures, such as the equipment access hatch cover and the drywell head, are provided with double seals and with a test tap which allows pressurizing the space between the seals without pressurizing the entire containment system. The leaktightness of the personnel air lock can be checked by pressurizing it independently.

Further discussion on inspection and testing may be found in Appendix I, "In-service Inspection;" Technical Specifications; and Table 5.2.2.

5.2.5.3 Isolation Valves

The test capabilities 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 lines containing two isolation valves in series which open into the containment atmosphere and do not terminate in closed loops outside the containment. Test taps are provided between the two valves to permit leakage monitoring of the first valve when the containment is pressurized, or which can be used to pressurize between the two valves to permit leakage testing of both valves simultaneously. The second category consists of those lines containing two isolation valves in series which connect to the reactor primary system. 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 up to the reactor primary system operating pressure.

Automatic or power operated isolation valve closing times are verified at least once per operating cycle or refuel outage in accordance with the In-Service Test Program.

Further discussion on inspection and testing may be found in Appendix I, "In-service Inspection"; Technical Specifications; Table 5.2.2, and Table 7.3.1 in subsection 7.3.

5.2.5.4 Containment Atmosphere Control System

The containment inerting system is proven operable by its use during normal plant operations. Portions of the system normally

closed to flow can be tested to ensure their operability and the integrity of the system.

5.2.5.5 Containment Atmospheric Dilution System

The post-LOCA CADS and the atmospheric analyzing system are functionally tested in accordance with plant procedures.

5.2 PRIMARY CONTAINMENT

REFERENCES

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15. "Safety Evaluation of 'BWR OWNER'S GROUP - Emergency Procedure Guidelines, Revision 4,' NEDO 31331, March 1987," dated September 12, 1988.

16. General Electric Document GENE-637-004-0993, Revision 1, "Evaluation of Two Combustible Gas Control Strategies Using NCAD" dated November 5, 1993.

17. Regulatory Guide 1.7, Revision 0, "CONTROL OF COMBUSTIBLE GAS CONCENTRATIONS IN CONTAINMENT FOLLOWING A LOSS OF COOLANT ACCIDENT," dated March 10, 1971.

18. NEDC-33064P Safety Analysis Report for Peach Bottom Atomic Power Station Units 2 & 3 Thermal Power Optimization.

19. NEDC-32938P Licensing Topical Report: Generic Guidelines and Evaluations for General Electric Boiling Water Reactor Thermal Power Optimization.

20. NEDC-33566P, Revision 0, "Safety Analysis Report for Exelon Peach Bottom Atomic Power Station Units 2 and 3 Constant Pressure Power Uprate," September 2012.

21. U.S. Nuclear Regulatory Commission, "Suppression Pool Temperature Limits for BWR Containments, Generic Technical Activity A-39," NUREG-0783, Revision 0, November 1981.

22. Regulatory Guide 1.183, Revision 0, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," dated July 2000.

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TABLE 5.2.1

PRINCIPAL DESIGN PARAMETERS AND CHARACTERISTICS OF PRIMARY CONTAINMENT**

Pressure suppression chamber,	
maximum internal pressure	62 psig
design internal pressure (code)*	56 psig
external design pressure	2 psi differential
Drywell, maximum internal pressure	62 psig
design internal pressure (code)	56 psig
external design pressure	2 psi differential
Drywell free volume	159,000 cu ft min 175,800 cu ft max
Pressure suppression chamber free volume	127,700 to 132,000 cu ft (approx)
Pressure suppression pool water volume	122,900 to 127,300 cu ft (approx)
Submergence of vent pipe below pressure suppression pool surface	4-4.4 ft
Design temperature of drywell	281°F
Design temperature of pressure suppression chamber	281°F
Loss coefficient for vent system including entrance and exit losses (based on vent exit flow area)	5.17
Heat exchanger K-value (single HX/cross-tie) (Unit 2)	305/500 Btu/sec°F
Break area/total vent area	0.0146
Drywell free volume/pressure suppression chamber free volume	1.20
Calculated maximum pressure after blow-down (no prepurge, initial pressure 2.0 psig)***	
Drywell	48.7 psig
Pressure suppression chamber	32.4 psig
Calculated max. suppression pool temp.	186°F
Dual unit interaction event	187.2°F
Small steam line break w/ dual unit inter.	187.6°F
Leakage rate at design pressure, 56 psig	0.7 percent by weight per day

*90 percent of maximum internal pressure as provided in paragraph N1312 (Winter 1965 Addenda), ASME Boiler and Pressure Vessel Code, Section III, Nuclear Vessels

**Include Mark I Containment Long-Term Program

*** These values are for operation with 90°F Feedwater Temperature Reduction.

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
	DRYWELL HEAD FLANGE	M-332	B	DOUBLE O-RING (1, 2, 4, 6)			
N-1	EQUIPMENT ACCESS	M-332	B	DOUBLE O-RING (1, 2, 4, 6)			
N-2	EQUIPMENT ACCESS WITH PERSONNEL LOCK	M-332	B	DOUBLE O-RING (1, 2, 4, 6)		RTV-2-07A-4119 (23,25) HV-3-07-50012 (23,26) HV-2(3)-36A-2(3)0446 (23)	
N-3	CONSTRUCTION MANWAY	M-332	A	SEAL WELDED			
N-4	DRYWELL HEAD ACCESS	M-332	B	DOUBLE O-RING (1, 2, 4, 6)			
N-5A-H	DRYWELL TO TORUS VENT LINES	S-52	A				24
N-6	CRD REMOVAL HATCH	M-332	B	DOUBLE O-RING (1,2,4,6)		RTV-3-07A-5113/ CAPPED (23, 26)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-7A	MAIN STEAM	M-351	C	AO-2(3)-01A-080A (1, 2, 3, 4, 5, 9, 11)	AO-2(3)-01A-086A (1, 2, 3, 4, 5)	HV-2(3)-01A-83A/ HV-2(3)-01A-84A/ CAPPED (31)	
		M-332	B	EXPANSION BELLOWS (1, 2, 4, 6)		HV-2(3)-07A-2(3)9834A (23)	
						HV-2(3)-07A-2(3)9835A (23)	
						HV-2(3)-07A-2(3)9836A (23)	
						HV-2(3)-07A-2(3)9837A (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-7B	MAIN STEAM	M-351	C	AO-2(3)-01A-080B (1,2,3,4,5,9,11)	AO-2(3)-01A-086B (1,2,3,4,5,)	HV-2(3)-01A-83B/ HV-2(3)-01A-84B/ CAPPED (31)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9834B (23)	
						HV-2(3)-07A-2(3)9835B (23)	
						HV-2(3)-07A-2(3)9836B (23)	
						HV-2(3)-07A-2(3)9837B (23)	
N-7C	MAIN STEAM	M-351	C	AO-2(3)-01A-080C (1,2,3,4,5,9,11)	AO-2(3)-01A-086C (1,2,3,4,5)	HV-2(3)-01A-83C/ HV-2(3)-01A-84C/ CAPPED (31)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9834C (23)	
						HV-2(3)-07A-2(3)9835C (23)	
						HV-2(3)-07A-2(3)9836C (23)	
						HV-2(3)-07A-2(3)9837C (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-7D	MAIN STEAM	M-351	C	AO-2(3)-01A-080D (1,2,3,4,5,9,11)	AO-2(3)-01A-086D (1,2,3,4,5)	HV-2(3)-01A-83D/ HV-2(3)-01A-84D/ CAPPED (31)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9834D (23)	
						HV-2(3)-07A-2(3)9835D (23)	
						HV-2(3)-07A-2(3)9836D (23)	
						HV-2(3)-07A-2(3)9837D (23)	
N-8	MAIN STEAM DRAIN	M-351	C	MO-2(3)-01A-074 (1,2,4,5,9,10)	MO-2(3)-01A-077 (1,2,4,5)	HV-2(3)-01A-75/ HV-2(3)-01A-76/ CAPPED (23)	

UFSAR TABLE 5.2.2
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-9A	FEEDWATER	M-351 M-356	C	CHK-2(3)-06-28A (1,2,4,5)	CHK-2(3)-06-96A (1,2,4,5) MO-2(3)-06-038A (1,2,4,5) MO-2(3)-23-019 (1,2,4,5)	HV-2(3)-06-35A/ HV-2(3)-06-34A/ CAPPED (23) HV-2(3)-23B-26/ HV-2(3)-23B-32/ HV-2(3)-23B-29/ HV-2(3)-23B-30/ CAPPED (23)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9838A (23) HV-2(3)-07A-2(3)9839A (23) HV-2(3)-07A-2(3)9840A (23) HV-2(3)-07A-2(3)9841A (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-9B	FEEDWATER	M-351 M-359 M-354	C	CHK-2(3)-06-28B (1,2,4,5)	CHK-2(3)-06-96B (1,2,4,5) MO-2(3)-06-038B (1,2,4,5) MO-2(3)-13-021 (1,2,4,5) MO-2(3)-12-068 (1,2,4,5)	HV-2(3)-06-35B/ HV-2(3)-06-34B/ CAPPED (23) HV-2(3)-12-60/ HV-2(3)-12-61/ CAPPED (23) HV-2(3)-13B-42/ HV-2(3)-13B-43/ HV-2(3)-13B-44/ HV-2(3)-13B-45/ CAPPED (23)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9838B/ (23) HV-2(3)-07A-2(3)9839B (23) HV-2(3)-07A-2(3)9840B (23) HV-2(3)-07A-2(3)9841B (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-10	STEAM TO RCIC TURBINE	M-359	C	MO-2(3)-13-015 (1,2,4,5,9,10)	MO-2(3)-13-016 (1,2,4,5)	HV-2(3)-13C-46A/ HV-2(3)-13C-47A/ CAPPED (23)	
N-11	STEAM TO HPCI TURBINE	M-365	C	MO-2(3)-23-015 (1,2,,4,5,9,10)	MO-2(3)-23-016 (1,2,4,5) AO-2-23C-4807 (1,2,4,5,25)	HV-2(3)-23C-27A/ HV-2(3)-23C-28A/ CAPPED (23)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9842 (23) HV-2(3)-07A-2(3)9843 (23)	
N-12	RHR SHUTDOWN COOLING SUCTION	M-361	C	MO-2(3)-10-018 (1,2,4,5,9,10,36) RV-2-10-23425 RV-3-10-33425 (1,2,4,5,9,36)	MO-2(3)-10-017 (1,2,4,5,36)	HV-2(3)-10-84 HV-2(3)-10-85/ CAPPED (23) HV-2(3)-10-2(3)1544/ HV-2(3)-10-2(3)1545/ RV-2-10-23425 CAPPED (29)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9844 (23) HV-2(3)-07A-2(3)9845 (23) HV-2(3)-07A-2(3)9846 (23) HV-2(3)-07A-2(3)9847 (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-13A	RHR SHUTDOWN COOLING RETURN & LPCI INJECTION	M-361	C	AO-2(3)-10-046B (1,2,4,5,36) HV-2-10-23451B (1,2,4,5,32,36) HV-3-10-33451B (1,2,4,5,32,36)	MO-2(3)-10-025B (1,2,4,5,36)	HV-2(3)-10-78B/ HV-2(3)-10-79B/ Capped (to places) (29)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9848A (23) HV-2(3)-07A-2(3)9849A (23) HV-2(3)-07A-2(3)9850A (23) HV-2(3)-07A-2(3)9851A (23)	
N-13B	RHR SHUTDOWN COOLING RETURN & LPCI INJECTION	M-361	C	AO-2(3)-10-046A (1,2,4,5,36) HV-2-10-23451A (1,2,4,5,32,36) HV-3-10-33451A (1,2,4,5,32,36)	MO-2(3)-10-025A (1,2,4,5,36)	HV-2(3)-10-78A/ HV-2(3)-10-79A/ Capped (two places) (29)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9848B (23) HV-2(3)-07A-2(3)9849B (23) HV-2(3)-07A-2(3)9850B (23) HV-2(3)-07A-2(3)9851B (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-14	RWCU PUMP SUCTION	M-354	C	MO-2(3)-12-015 (1,2,4,5,9,10)	MO-2(3)-12-018 (1,2,4,5)	HV-2(3)-12-16/ HV-2(3)-12-17/ CAPPED (23)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9852 (23) HV-2(3)-07A-2(3)9853 (23) HV-2(3)-07A-2(3)9854 (23) HV-2(3)-07A-2(3)9855 (23)	
N-15	PENETRATION DELETED	S-52					
N-16A	CORE SPRAY PUMP DISCHARGE	M-362	C	AO-2(3)-14-013B (1,2,4,5) HV-2-14-29046B (1,2,4,5,32,36) HV-3-14-39046B (1,2,4,5,32,36)	MO-2(3)-14-012B (1,2,4,5,36)	HV-2(3)-14-74B/ HV-2(3)-14-75B/ CAPPED (TWO PLACES) (29)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9856A (23) HV-2(3)-07A-2(3)9857A (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-16B	CORE SPRAY PUMP DISCHARGE	M-362	C	AO-2(3)-14-013A (1,2,4,5) HV-2-14-29046A (1,2,4,5,32,36) HV-3-14-39046A (1,2,4,5,32,36)	MO-2(3)-14-012A (1,2,4,5,36)	HV-2(3)-14-74A/ HV-2(3)-14-75A/ CAPPED (TWO PLACES) (29)	
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9856B (23) HV-2(3)-07A-2(3)9857B (23)	

UFSAR TABLE 5.2.2

CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-17	RHR REACTOR VESSEL HEAD SPRAY OUT OF SERVICE	M-361	A	SEAL WELDED UNIT 3 ONLY	SEAL WELDED UNIT 2 ONLY		
		M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9858 (23) HV-2(3)-07A-2(3)9859 (23) HV-2(3)-07A-2(3)9860 (23) HV-2(3)-07A-2(3)9861 (23)	
N-18	DRYWELL FLOOR DRAIN PUMP DISCHARGE	M-368 M-369	C	AO-2(3)-20-082 (1,2,4,5,9,11)	AO-2(3)-20-083 (1,2,4,5)	HV-2(3)-20A-2(3)7040/ CAPPED (23)	
N-19	DRYWELL EQUIPMENT DRAIN PUMP DISCHARGE	M-368 M-369	C	AO-2(3)-20-094 (1,2,4,5,9,11)	AO-2(3)-20-095 (1,2,4,5)	HV-2(3)-20B-2(3)7041/ CAPPED (23)	
N-20	SPARE	S-52	A	SEAL WELDED			
N-21	SERVICE AIR SUPPLY	M-320	C	HV-2(3)-36A-2(3)0165 (1,2,4,5,9,11)	HV-2(3)-36A-2(3)0163 (1,2,4,5)		

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-22	INSTRUMENT NITROGEN SUPPLY	M-333	C	CHK-2(3)-16-2(3)3202A (1,2,4,5)	AO-2(3)-16-2(3)969A (1,2,4,5)	HV-2(3)-16-2(3)3301A/ CAPPED (23) HV-2-16-23302A/ CAPPED (23, 25) HV-3-16-33302A/ HV-3-16-33303A/ CAPPED (23, 26)	
N-23	RBCW TO RECIRC PUMPS	M-316	C	CLOSED SYSTEM	MO-2(3)-35-2(3)373 (1,2,4,5)	HV-2(3)-35-2(3)4028/ CAPPED (23)	
N-24	RBCW FROM RECIRC PUMPS	M-316	C	CLOSED SYSTEM	MO-2(3)-35-2(3)374 (1,2,4,5)	HV-2(3)-35-2(3)4030/ CAPPED (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-25	DRYWELL AND TORUS PURGE SUPPLY AND VACUUM RELIEF	M-367	C	CHK-2(3)-07B-4(5)0095A (1,2,4,5)	AO-2(3)-07B-2(3)523 (1,2,4,5)	HV-2(3)-7B-4(5)0021/ CAPPED (23)	27
				AO-2(3)-07B-2(3)520 (1,2,4,5,9,12)	AO-2(3)-07B-2(3)502A (1,2,4,5,9,12)	HV-2(3)-07B-4(5)0019/ CAPPED (23)	
					AO-2(3)-07B-2(3)505 (1,2,4,5)	HV-2(3)-07B-4(5)0027/ HV-2(3)-07B-4(5)0028/ CAPPED (23)	
					AO-2(3)-07B-2(3)521A (1,2,4,5)	HV-2(3)-07B-4(5)0020/ CAPPED (23)	
					AO-2(3)-07B-2(3)521B (1,2,4,5,9,12)		
					AO-2(3)-07B-2(3)519 (1,2,4,5,12)	HV-2(3)-07B-4(5)0018	
			B	DOUBLE O-RING FOR AO-2(3)-7B-2(3)520 (1,2,4,6)			
			A	DPIS-2(3)503A			

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-26	DRYWELL PURGE EXHAUST	M-367 M-372	C	SV-2(3)-07D-2(3)671G (1,2,4,5)	SV-2(3)-07D-2(3)978G (1,2,4,5)	HV-2(3)-07D-4(5)0031/ CAPPED (23)	
				AO-2(3)-07B-2(3)506 (1,2,4,5,9,12)	AO-2(3)-07B-2(3)507 (1,2,4,5)	HV-2(3)-07D-4(5)0008/ CAPPED (23)	
				AO-2(3)-07B-2(3)509 (1,2,4,5,9,11)	AO-2(3)-07B-2(3)510 (1,2,4,5)	HV-2(3)-07B-4(5)0033/ CAPPED (23)	
					SV-2(3)-16-8(9)100 (1,2,4,5)		
					AO-2(3)-16-4(5)235 (1,2,4,5)	HV-2(3)-07B-4(5)0032/ CAPPED (23)	
				SV-2(3)-07E-4(5)960B (1,2,4,5)	SV-2(3)-07E-4(5)961B (1,2,4,5)	HV-2(3)-07B-4(5)0047/ HV-2(3)-07B-4(5)0048/ CAPPED (23)	
					SV-2(3)-63G-4(5)966B (1,2,4,5)	HV-2(3)-07E-4(5)0034/ CAPPED (23)	
					SV-2(3)-63G-8(9)101 (1,2,4,5)		
			B	DOUBLE O-RING FOR AO-2(3)-07B-2(3)506 (1,2,4,6)			
			A	PT-2(3)508A			
				PT-2(3)508B			
N-26A	INSTR LINE - RPV LEVEL AND PRESS.	M-352	A	RO-8(9)0338A	XFC-2(3)-02-37A		

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-26B	INSTR LINE - RPV LEVEL AND PRESS.	M-352	A	RO-8(9)0338C	XFC-2(3)-02-37B		
N-27A UNIT 2	INSTR LINE - RPV BOTTOM HEAD DRAIN LINE FLOW	M-354	A	RO-80476A			
N-27A UNIT 3	SPARE	M-353	A	CAPPED			
N-27B	SPARE	M-353	A	CAPPED			
N-27C UNIT 2	INSTR LINE - RPV BOTTOM HEAD DRAIN LINE FLOW	M-354	A	RO-80476B	XFC-2-12-80457H		
N-27C UNIT 3	SPARE	M-353	A	CAPPED			
N-27D	SPARE	M-353	A	CAPPED			
N-27E	INSTR LINE - CORE PLATE PRESS. ABOVE	M-352	A	RO-8(9)0341A	XFC-2(3)-02-25		
N-27F	INSTR LINE - CORE PLATE PRESS. BELOW	M-352	A	RO-8(9)0341B	XFC-2(3)-02-27		
N-28A	INSTR LINE - RPV LEVEL AND PRESS.	M-352	A	RO-8(9)0339A	XFC-2(3)-02-17A		

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-28B	INSTR LINE -RPV LEVEL AND PRESS.	M-352	A	RO (MK-1)	XFC-2(3)-02-19A	RTV-2-02-28A/ XFC-2-02-29A/ WELDED CAP (23, 25) RTV-3-02-28A/ XFC-3-02-29A/ CAPPED (23, 26)	
N-28C	INSTR LINE - RPV LEVEL	M-352	A	RO-8(9)0337	XFC-2(3)-02-11		
N-28D	INSTR LINE - RPV FLANGE LEAK DETECTION	M-351	A	RO-8(9)0335	XFC-2(3)-02-23		
N-28E	SPARE	M-352	A	CAPPED			
N-28F	INSTR LINE - RPV LEVEL	M-352	A	RO-8(9)0338B	XFC-2(3)-02-15A		
N-29A UNIT 2	INSTR LINE - RPV LEVEL	M-352	A	RO-80339B	XFC-2-02-17B		
N-29A UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-29B	SPARE	S-52	A	SEAL WELDED			
N-29C	SPARE	S-52	A	SEAL WELDED			

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-29D UNIT 2	INSTR LINE - RPV LEVEL AND PRESS	M-352	A	RO (MK-1)	XFC-2-02-19B	RTV-2-02-28B/ XFC-2-02-29B/ WELDED CAP (23)	
N-29D UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-29E UNIT 2	INSTR LINE - RPV LEVEL	M-352	A	RO-80338D	XFC-2-02-15B		
N-29E UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-29F UNIT 2	SPARE	M-352	A	CAPPED			
N-29F UNIT 3	INSTR LINE -RPV LEVEL	M-352	A	RO-90338D	XFC-3-02-15B		
N-30A	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-8(9)0336B	XFC-2(3)-02-73A		
N-30B	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-80336D RO-90336C	XFC-2(3)-02-73C		
N-30C	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-8(9)0336F	XFC-2(3)-02-73E		
N-30D	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-8(9)0336H	XFC-2(3)-02-73G		

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-30E	INSTR LINE - RECIRC LOOP B FLOW	M-353	A	RO-8(9)0483D	XFC-2(3)-02-64D		
N-30F	INSTR LINE - RECIRC LOOP B FLOW	M-353	A	RO-8(9)0483C	XFC-2(3)-02-64C		
N-31A	INSTR LINE - RECIRC PUMP SEAL PRESSURE	M-353	A	RO-8(9)129A	XFC-2(3)-02-07A		
N-31B	INSTR LINE - RECIRC PUMP SEAL PRESSURE	M-353	A	RO-8(9)129B	XFC-2(3)-02-07B		
N-31C	INSTR LINE - RECIRC PUMP SEAL PRESSURE	M-353	A	RO-8(9)128A	XFC-2(3)-02-08A		
N-31D	INSTR LINE - RECIRC PUMP SEAL PRESSURE	M-353	A	RO-8(9)128B	XFC-2(3)-02-08B		
N-31E	SPARE	S-52	A	SEAL WELDED			
N-31F	SPARE	S-52	A	SEAL WELDED			
N-32A	INSTR LINE - RECIRC LOOP A FLOW	M-353	A	RO-8(9)0483A	XFC-2(3)-02-64A		
N-32B	INSTR LINE - RECIRC LOOP A FLOW	M-353	A	RO-8(9)0483B	XFC-2(3)-02-64B		

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-32C	ILRT CONNECTION	M-332	C	HV-2(3)-07A-2(3)9871 (1,2,4,5,13)	HV-2(3)-07A-2(3)9872 (1,2,4,5,13)		
N-32D	ILRT CONNECTION	M-332	C	HV-2(3)-07A-2(3)9873 (1,2,4,5,13)	HV-2(3)-07A-2(3)9874 (1,2,4,5,13)		
N-32E	INSTR LINE - CORE SPRAY LINE BREAK DETECTION	M-362	A	RO-8(9)0330B	XFC-2(3)-14-31B		
N-32F	INSTR LINE - CORE SPRAY lINE BREAK DETECTION	M-362	A	RO-8(9)0330A	XFC-2(3)-14-31A		
N-33A	INSTR LINE - RECIRC PUMP	M-353	A	RO-8(9)0481A	XFC-2(3)-02-62A	RTV-2(3)-02A-2(3)3037A/ RTV-2(3)-02A-4(5)448A (29)	
N-33B	INSTR LINE - RECIRC PUMP	M-353	A	RO-8(9)0482A	XFC-2(3)-02-62B	RTV-2(3)-02A-23038A/ RTV-2-02A-4449A (25,29) RTV-3-02A-5449A (26,29)	
N-33C	INSTR LINE - RECIRC PUMP	M-353	A	RO-8(9)0481B	XFC-2(3)-02-62C	RTV-2(3)-02A-2(3)3037B/ RTV-2(3)-02A-4(5)448B (29)	
N-33D	INSTR LINE - RECIR PUMP	M-353	A	RO-8(9)0482B	XFC-2(3)-02-62D	RTV-2-02A-23038B/ RTV-2-02A-4449B (25,29) RTV-3-02A-5449B (26,29)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-33E	SPARE	S-52	A	SEAL WELDED			
N-33F	INSTR LINE - DRYWELL PRESSURE	M-367	A	PT-4(5)805 DPT-8(9)143			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-34A	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-8(9)0336A	XFC-2(3)-02-73B		
N-34B	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-80336C RO-90336D	XFC-2(3)-02-73D		
N-34C	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-8(9)0336E	XFC-2(3)-02-73F		
N-34D	INSTR LINE - MAIN STEAM FLOW	M-351	A	RO-8(9)0336G	XFC-2(3)-02-73H		
N-34E	INSTR LINE - HPCI STEAM FLOW	M-365	A	RO-8(9)0328	XFC-2(3)-23-37A		
N-34F	INSTR LINE - HPCI STEAM FLOW	M-365	A	RO-8(9)0327	XFC-2(3)-23-37B		
N-35A	SPARE	M-376	B	DOUBLE O-RING FOR BLIND FLANGE (1,2,4,6)			
N-35B UNIT 2	CAPPED SPARE	M-376	C	CAPPED			
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-35B UNIT 3	CAPPED SPARE	M-376	C	CAPPED			
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35C UNIT 2	CAPPED SPARE	M-376	C	CAPPED			
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35C UNIT 3	TIP PURGE	M-376	C	CHK-3-07F-51504 (1,2,4,5)	SV-3-07-109 (1,2,4,5)	HV-3-07F-51508/ CAPPED (23) HV-3-07F-51507/ CAPPED (23)	
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-35D UNIT 2	TIP PURGE	M-376	C	CHK-2-07F-41504 (1,2,4,5)	SV-2-07-109 (1,2,4,5)	HV-2-07F-41508/ CAPPED (23) HV-2-07F-41507/ CAPPPED (23)	
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35D UNIT 3	CAPPED SPARE	M-376	C	CAPPED			
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35E UNIT 2	TIP DRIVE	M-376	C	SV-2-07-104A (1,2,4,5,33)	XV-2-07-102A (18,33)		
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-35E UNIT 3	TIP DRIVE	M-376	C	XV-3-07-102C (18,33)	SV-3-07-104C (1,2,4,5,33)		
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35F UNIT 2	TIP DRIVE	M-376	C	SV-2-07-104C (1,2,4,5,33)	XV-2-07-102C (18,33)		
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35F UNIT 3	TIP DRIVE	M-376	C	XV-3-07-102A (18,33)	SV-3-07-104A (1,2,4,5,33)		
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-35G UNIT 2	TIP DRIVE	M-376	C	SV-2-07-104B (1,2,4,5,33)	XV-2-07-102B (18,33)		
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-35G UNIT 3	TIP DRIVE	M-376	C	XV-3-07-102B (18,33)	SV-3-07-104B (1,2,4,5,33)		
			B	DOUBLE O-RING FOR FLANGED JOINT (1,2,4,6)			
N-36	CRD RETURN (ABANDONED)	S-52	A	WELDED CAP			
N-37A THRU D	CRD INSERT	M-357	C	WATER SEAL	CRD BALL CHECK (17) HCU (17)	HV-2(3)-03A-107XX/ CAPPED (23)	30

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-38A THRU D	CRD WITHDRAWAL	M-357 M-356	C	WATER SEAL	HCU (17)	HV-2(3)-03A-106XX/ CAPPED (23)	30
			C	AO-2(3)-03-32A (1,2,4,5,17)	AO-2(3)-03-35A (1,2,4,5,17)	HV-2(3)-03-2(3)1675/ CAPPED (23)	
				AO-2(3)-03-32B (1,2,4,5,17)	AO-2(3)-03-35B (1,2,4,5,17)	HV-2(3)-03-2(3)1653/ CAPPED (23)	
				AO-2(3)-03-33 (1,2,4,5,17)	AO-2(3)-03-36 (1,2,4,5,17)	HV-2(3)-03-117/ CAPPED (23)	
			A	WATER SEAL	LS-231A (17) LS-231B (17) LS-231C (17) LS-231D (17) LS-231E (17)		

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-39A	RHR CONTAINMENT SPRAY	M-361 M-372	C	MO-2(3)-10-031B (1,2,4,5,9,10,36)	MO-2(3)-10-026B (1,2,4,5,36)	HV-2-07C-40024/ CAPPED (23) HV-3-07C-50029	
				CHK-2-07C-40143 (1,2,4,5,25)	SV-2-07C-4949B (1,2,4,5,25)	HV-3-07C-50030 HV-2-07C-40025/ CAPPED (23)	
				CHK-3-07C-50142 (1,2,4,5,26)	SV-3-07C-5949A (1,2,4,5,26)	HV-2(3)-10-52B/ HV-2(3)-10-50B/ CAPPED (23)	
						HV-2-10-21556B/ HV-2-10-21557B/ (23,25)	
			B	PACKING FOR MO-2(3)-10-031B (1,2,4,6)	PACKING FOR MO-2(3)-10-026B (1,2,4,6)	HV-3-10-31556B/ HV-3-10-31589B/ HV-3-10-31557B (23,26)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-39B	RHR CONTAINMENT SPRAY	M-361 M-372	C	MO-2(3)-10-031A (1,2,4,5,9,10,36)	MO-2(3)-10-026A (1,2,4,5,36)	HV-3-07C-50025 HV-2-07C-40029/ CAPPED (23)	
				CHK-2-07C-40142 (1,2,4,5,25)	SV-2-07C-4949A (1,2,4,5,25)	HV-3-07C-50024 HV-2-07C-40030/ CAPPED (23)	
				CHK-3-07C-50143 (1,2,4,5,26)	SV-3-07C-5949B (1,2,4,5,26)	HV-2(3)-10-52A/ HV-2(3)-10-50A/ CAPPED (23)	
						HV-3-10-31556A/ HV-3-10-31557A/ (23, 26)	
			B	PACKING FOR MO-2(3)-10-031A (1,2,4,6)	PACKING FOR MO-2(3)-10-026A (1,2,4,6)	HV-2-10-21556A/ HV-2-10-21589A/ HV-2-10-21590A/ CAPPED/ HV-2-10-21557A (22, 25)	
N-40A THRU D	INSTR LINE - JET PUMPS	M-352	A	RO-8(9)0340A TO Z	XFC-2(3)-02-21A TO D XFC-2(3)-02-23A TO D XFC-2(3)-02-31B TO W		
N-41	RECIRC LOOP SAMPLE	M-353	C	AO-2(3)-02-039 (1,2,4,5,9,11)	AO-2(3)-02-040 (1,2,4,5)	HV-2(3)-02E-041/ HV-2(3)-02E-042/ CAPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-42	STANDBY LIQUID	M-351	C	CHK-2(3)-11-016 (1,2,4,5,35)	XV-2(3)-11-014A (1,2,4,5,19,35)	HV-2(3)-11-36/ HV-2(3)-11-37/ CAPPED (23)	
					XV-2(3)-11-014B (1,2,4,5,19,35)	HV-2(3)-11-2(3)3132/ HV-2(3)-11-2(3)3133/ CAPPED (23)	
				Water Seal (35)	CHK-2(3)-11-016 (1,2,4,5,35)		
N-43 UNIT 2	SPARE	S-52	A	SEAL WELDED			25
N-44	SPARE	S-52	A	SEAL WELDED			
N-45 UNIT 2	SPARE	S-52	A	SEAL WELDED			25
N-46 UNIT 2	SPARE	S-52	A	SEAL WELDED			25
N-46A UNIT 3	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-9102A PT-100A PT-3-05-12A PS-3-05-16 CAPPED			26

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-46B UNIT 3	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-9102C PT-100C PT-3-05-12B			26
N-46C UNIT 3	SPARE	S-52	A	SEAL WELDED			26
N-46D UNIT 3	SPARE	S-52	A	SEAL WELDED			26
N-46E UNIT 3	SPARE	S-52	A	SEAL WELDED			26
N-46F UNIT 3	SPARE	S-52	A	SEAL WELDED			26
N-47	ADS SAFETY GRADE PNEUMATIC SUPPLY	M-333	C	CHK-2(3)-16A-2(3)3299B (1,2,4,5)	SV-2(3)-16A-8(9)130B (1,2,4,5) HV-2(3)-16A-2(3)3468B (1,2,4,5)	HV-2(3)-16A-2(3)3157B/ CAPPED (23) HV-2(3)-16A-2(3)3156B/ CAPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-48	SPARE	S-52	A	SEAL WELDED			
N-49A	SPARE	S-52	A	SEAL WELDED			
N-49B UNIT 2	SPARE	S-52	A	SEAL WELDED			
N-49B UNIT 3	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-3-05-12C PT-100B PT-9102B			
N-49C UNIT 2	SPARE	S-52	A	SEAL WELDED			
N-49C UNIT 3	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-9458 PT-9102D PT-3-05-12D PT-100D			
N-49D	SPARE	S-52	A	SEAL WELDED			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-49E UNIT 2	INSTR LINE - DRYWELL PRESSURE	M-361	A	PS-2-05-16 PT-2-05-12A PT-8102A CAPPED PT-100A			
N-49E UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-49F UNIT 2	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-2-05-12B PT-8102C PT-100C			
N-49F UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-50A	INSTR LINE - RECIRC SUCTION PRESSURE	M-353	A	RO-80484A (25) RO-90485A (26)	XFC-2(3)-02-305A		
N-50B	INSTR LINE -RCIC STEAM PRESSURE	M-359	A	RO-80308 (25) RO-90307 (26)	XFC-2-13-55B (25) XFC-3-13-55A (26)		
N-50C	INSTR LINE - RCIC STEAM PRESSURE	M-359	A	RO-80307 (25) RO-90308 (26)	XFC-2-13-55A (25) XFC-3-13-55B (26)		

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-50D	INSTR LINE - RWCU PUMP SUCTION PRESS	M-354	A	RO-125A	XFC-2(3)-12-66A		
N-50E	INSTR LINE - RWCU PUMP SUCTION PRESS	M-354	A	RO-125B	XFC-2(3)-12-66B		
N-50F	SPARE	S-52	A	SEAL WELDED			
N-51A	CACS SAMPLE LINE	M-367	C	SV-2(3)-07D-2(3)671E (1,2,4,5)	SV-2(3)-07D-2(3)978E (1,2,4,5)	HV-2(3)-07D-4(5)0062/ CAPPED (23) HV-2(3)-07D-4(5)0006/ CAPPED (23)	
N-51B	CACS SAMPLE LINE	M-367	C	SV-2(3)-07D-2(3)671D (1,2,4,5)	SV-2(3)-07D-2(3)978D (1,2,4,5)	HV-2(3)-07D-4(5)0061/ CAPPED (23) HV-2(3)-07D-4(5)0005/ CAPPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-51C	CACS SAMPLE LINE	M-367 M-372	C	SV-2(3)-07D-2(3)671C (1,2,4,5) SV-2(3)-07E-4(5)960C (1,2,4,5)	SV-2(3)-07D-2(3)978C (1,2,4,5) SV-2(3)-07E-4(5)961C (1,2,4,5) SV-2(3)-63G-4(5)966C (1,2,4,5) SV-2(3)-63G-8(9)101 (1,2,4,5)	HV-2(3)-07D-4(5)0060/ CAPPED (23) HV-2(3)-07D-4(5)0004/ CAPPED (23) HV-2(3)-07E-4(5)0010/ CAPPED (23)	
N-51D	CACS SAMPLE RETURN	M-367	C	CHK-2(3)-07D-4(5)0140 (1,2,4,5)	SV-2(3)-07D-2(3)980 (1,2,4,5)	HV-2(3)-07D-4(5)0064/ CAPPED (23) HV-2(3)-07D-4(5)0063/ CAPPED (23)	
N-51E	INSTR LINE - RECIRC SUCTION PRESSURE	M-353	A	RO-80485A (25) RO-90484A (26)	XFC-2(3)-02-305B		
N-51F	SPARE	S-52	A	SEAL WELDED			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-52A	SPARE	M-353	A	CAPPED			
N-52B	SPARE	M-353	A	CAPPED			
N-52C	SPARE	M-353	A	CAPPED			
N-52D	SPARE	M-353	A	CAPPED			
N-52E	INSTR LINE - CORE PLATE PRESSURE	M-352	A	RO-8(9)0342	XFC-2(3)-02-33		
N-52F UNIT 2	INSTRUMENT NITROGEN SUPPLY	M-333	C	CHK-2-16-23202B (1,2,4,5) CHK-2-16-23335 (1,2,4,5)	AO-2-16-2969B (1,2,4,5) HV-2-16-23333 (1,2,4,5)	HV-2-16-23302B/ CAPPED (23) HV-2-16-23301B/ CAPPED (23) HV-2-16-23334/ CAPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-52F UNIT 3	INSTRUMENT NITROGEN SUPPLY	M-333	C	CHK-3-16-33202B (1,2,4,5) CHK-3-16-33312 (1,2,4,5)	AO-3-16-3969B (1,2,4,5) HV-3-16-33310 (1,2,4,5)	HV-3-16-33302B/ HV-3-16-33303B/ CAPPED (23) HV-3-16-33301B/ CAPPED (23) HV-3-16-33311/ CAPPED (23)	
N-53	CHILLED WATER FROM DRYWELL COOLERS LOOP A	M-327	C	CLOSED SYSTEM	MO-2(3)-44A-2(3)201B (1,2,4,5)	HV-2(3)-44A-2(3)33530A/ CAPPED (23)	
N-54	CHILLED WATER FROM DRYWELL COOLERS LOOP B	M-327	C	CLOSED SYSTEM	MO-2(3)-44A-2(3)200B (1,2,4,5)	HV-2(3)-44A-2(3)-3530B/ CAPPED (23)	
N-55	CHILLED WATER TO DRYWELL COOLERS LOOP B	M-327	C	CLOSED SYSTEM	M-2(3)-44A-2(3)200A (1,2,4,5)	HV-2(3)-44A-2(3)3523B/ CAPPED (23)	
N-56	CHILLED WATER TO DRYWELL COOLERS LOOP A	M-327	C	CLOSED SYSTEM	MO-2(3)-44A-2(3)201A (1,2,4,5)	HV-2(3)-44A-2(3)3523A/ CAPPED (23)	
N-57	MAIN STEAM LINE D SAMPLE	M-351	C	AO-2(3)-02-316 (1,2,4,5,9,11)	AO-2(3)-02-317 (1,2,4,5)	HV-2(3)-01J-318/ HV-2(3)-01J-319/ CAPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-58 Unit 3	SPARE	S-52	A	SEAL WELDED			
N-100A	NEUTRON MONITORING	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9807A (23) HV-2(3)-07A-2(3)9808A (23)	
N-100B UNIT 2	SPARE	S-52	A	SEAL WELDED			
N-100BA UNIT 3	INSTR LINE - RPV LEVEL	M-352	A	RO-90339B	XFC-3-02-17B		
N-100BB UNIT 3	SPARE	S-52	A	SEAL WELDED			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-100BC UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-100BD UNIT 3	INSTR LINE - RPV LEVEL AND PRESS	M-352	A	RO (MK-1)	XFC-3-02-19B	RTV-3-02-28B/ XFC-3-02-29B/ CAPPED (23)	
N-100BE UNIT 3	SPARE	M-352	A	CAPPED			
N-100BF UNIT 3	SPARE	M-352	A	CAPPED			
N-100C	NEUTRON MONITORING	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9807C (23) HV-2(3)-07A-2(3)9808C (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-100E	NEUTRON MONITORING	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9807E (23) HV-2(3)-07A-2(3)9808E (23)	
N-100F	SPARE	S-52	A	SEAL WELDED			
N-101A	RECIRC PUMP POWER	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9810A (23) HV-2(3)-07A-2(3)9811A (23)	
N-101B	RECIRC PUMP POWER	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9810B (23) HV-2(3)-07A-2(3)9811B (23)	
N-101C	RECIRC PUMP POWER	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9810C (23) HV-2(3)-07A-2(3)9811C (23)	
N-101D	RECIRC PUMP POWER	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9810D (23) HV-2(3)-07A-2(3)9811D (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-101E	RECIRC PUMP POWER	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9810E (23) HV-2(3)-07A-2(3)9811E (23)	
N-101F	RECIRC PUMP POWER	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9810F (23) HV-2(3)-07A-2(3)9811F (23)	
N-102A	SPARE	S-52	A	SEAL WELDED			
N-102BA UNIT 2	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-2-05-12C PT-8102B PT-100B			
N-102BA UNIT 3	SPARE	S-52	A	SEAL WELDED			
N-102BB UNIT 2	INSTR LINE - DRYWELL PRESSURE	M-361	A	PT-2-05-12D PT-8102D PT-100D PT-8458			
N-102BB UNIT 3	SPARE	S-52	A	SEAL WELDED			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-102BC	ADS SAFETY GRADE PNEUMATIC SUPPLY	M-333	C	CHK-2(3)-16A-2(3)3299A (1,2,4,5)	SV-2(3)-16A-8(9)130A (1,2,4,5)	HV-2(3)-16A-2(3)3157A/ CAPPED (23) HV-2(3)-16A-2(3)3156A/ CAPPED (23)	
N-102BD UNIT 2	SPARE	S-52	A	SEAL WELDED			
N-102BD UNIT 3	BREATHING AIR	M-373	C	HV-3-36E-54762 (1,2,4,5,9,20)	HV-3-36E-50078 (1,2,4,5,9)	HV-3-36E-50079/ HV-3-36E-50080/ CAPPED (23)	
N-103A	SPARE	S-52	A	SEAL WELDED			

UFSAR TABLE 5.2.2
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-103B	ELECTRICAL - THERMOCOUPLES	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9813B (23) HV-2(3)-07A-2(3)9814B (23)	
N-104A	ELECTRICAL - CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816A (23) HV-2(3)-07A-2(3)9817A (23)	
N-104B	ELECTRICAL - CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816B (23) HV-2(3)-07A-2(3)9817B (23)	
104C	ELECTRICAL CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816C (23) HV-2(3)-07A-2(3)9817C (23)	
N-104D	ELECTRICAL CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816D (23) HV-2(3)-07A-2(3)9817D (23)	

UFSAR TABLE 5.2.2
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COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-104E	ELECTRICAL CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816E (23) HV-2(3)-07A-2(3)9817E (23)	
N-104F	ELECTRICAL CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816F (23) HV-2(3)-07A-2(3)9817F (23)	
N-104G	ELECTRICAL CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816G (23) HV-2(3)-07A-2(3)9817G (23)	
N-104H	ELECTRICAL CONTROL ROD POSITION INDICATION	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9816H (23) HV-2(3)-07A-2(3)9817G/ (23)	
N-105A	ELECTRICAL POWER, LIGHTS, FANS	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9819A (23) HV-2(3)-07A-2(3)9820A (23)	
N-105B	ELECTRICAL POWER, LIGHTS, FANS	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9819B (23) HV-2(3)-07A-2(3)9820B (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-105C	ELECTRICAL POWER, LIGHTS, FANS	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9819C (23) HV-2(3)-07A-2(3)9820C (23)	
N-105D	ELECTRICAL POWER, LIGHTS, FANS	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9819D (23) HV-2(3)-07A-2(3)9820D (23)	
N-106A	ELECTRICAL INDICATION AND CONTROL	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9822A (23) HV-2(3)-07A-2(3)9823A (23)	
N-106B	ELECTRICAL INDICATION AND CONTROL	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9822B (23) HV-2(3)-07A-2(3)9823B (23)	
N-106C	ELECTRICAL INDICATION AND CONTROL	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)-9822C (23) HV-2(3)-07A-2(3)9823C (23)	
N-106D	ELECTRICAL INDICATION AND CONTROL	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)-9822D (23) HV-2(3)-07A-2(3)9823D (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-107	ELECTRICAL - THERMOCOUPLES	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9825 (23) HV-2(3)-07A-2(3)9826 (23)	
N-108	SPARE	S-52	A	SEAL WELDED			
N-109A	COMMUNICATION AND LIGHTS - PERSONNEL AIR LOCK	S-52	B	TESTED CONCURRENTLY WITH PENETRATION N-2			
N-109B	SPARE	S-52	A	SEAL WELDED			
N-110A THRU H	RPV STABILIZER ASSEMBLY MANHOLE	M-332	B	DOUBLE O-RING (1,2,4,6)			
N-150	TEST NOZZLE	M-332	B	DOUBLE O-RING (1,2,4,6)		HV-3-07-50026/ CAPPED (23,26)	
N-200A	ACCESS HATCH	M-332	B	DOUBLE O-RING (1,2,4,6)		RTV-2(3)-07A-4(5)110/ CAPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-200B	ACCESS HATCH	M-332	B	DOUBLE O-RING (1,2,4,6)		RTV-3-07A-5114/ CAPPED (23)	
N-201A	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800A (23) HV-2(3)-07A-2(3)9801A (23) HV-2(3)-07A-2(3)9802A (23) HV-2(3)-07A-2(3)9803A (23)	
N-201B	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800B (23) HV-2(3)-07A-2(3)9801B/ (23) HV-2(3)-07A-2(3)9802B/ (23) HV-2(3)-07A-2(3)9803B (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-201C	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800C (23) HV-2(3)-07A-2(3)9801C (23) HV-2(3)-07A-2(3)9802C (23) HV-2(3)-07A-2(3)9803C (23)	
N-201D	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800D (23) HV-2(3)-07A-2(3)9801D (23) HV-2(3)-07A-2(3)9802D (23) HV-2(3)-07A-2(3)9803D (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-201E	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800E (23) HV-2(3)-07A-2(3)9801E (23) HV-2(3)-07A-2(3)9802E (23) HV-2(3)-07A-2(3)9803E (23)	
N-201F	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800F (23) HV-2(3)-07A-2(3)9801F (23) HV-2(3)-07A-2(3)9802F (23) HV-2(3)-07A-2(3)9803F (23)	

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-201G	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800G (23) HV-2(3)-07A-2(3)9801G (23) HV-2(3)-07A-2(3)9802G (23) HV-2(3)-07A-2(3)9803G/ (23)	
N-201H	SUPPRESSION CHAMBER TO DRYWELL VENT	M-332	B	EXPANSION BELLOWS (1,2,4,6)		HV-2(3)-07A-2(3)9800H (23) HV-2(3)-07A-2(3)9801H (23) HV-2(3)-07A-2(3)9802H (23) HV-2(3)-07A-2(3)9803H (23)	
N-202A THRU M	DRYWELL VACUUM BREAKERS	S-54	N/A	PENETRATION INTERNAL TO CONTAINMENT			

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-203	CACS AND CAD SAMPLE LINES	M-367 M-372	C	SV-2(3)-07D-2(3)671B (1,2,4,5)	SV-2(3)-07D-2(3)978B (1,2,4,5)	HV-2(3)-07D-4(5)0055/ CAPPED (23)	
				SV-2(3)-07E-4(5)960D (1,2,4,5)	SV-2(3)-07E-4(5)961D (1,2,4,5)	HV-2(3)-07D-4(5)0003/ CAPPED (23)	
					SV-2(3)-63G-4(5)966D (1,2,4,5)	HV-2(3)-07E-4(5)0056/ CAPPED (23)	
					SV-2(3)-63G-8(9)101 (1,2,4,5)		
			A	PT-4(5)953			
N-204A THRU F	PENETRATIONS DELETED	S-54					
N-205A	TORUS VACUUM BREAKER	M-367	C	AO-2(3)-07B-2(3)502B (1,2,4,5,9,21)	VBV-2(3)-07B-026B (1,2,4,5)	HV-2(3)-07B-4(5)0001/ CAPPED (23)	
			B	DOUBLE O-RING FOR AO-2(3)-07B-2502B (1,2,4,6)			
			A	DPIS-2(3)503B DPT-8(9)143			

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-205B	DRYWELL AND TORUS PURGE SUPPLY AND VACUUM RELIEF	M-367	C	AO-2(3)-07B-2(3)502A (1,2,4,5,9,12) AO-2(3)-07B-2(3)521B (1,2,4,5,9,12)	VBV-2(3)-07B-026A (1,2,4,5) AO-2(3)-07B-2(3)521A (1,2,4,5) AO-2(3)-07B-2(3)505 (1,2,4,5) AO-2(3)-07B-2(3)520 (1,2,4,5,9,12) AO-2(3)-07B-2(3)519 (1,2,4,5,12)	HV-2(3)-07B-4(5)0027/ HV-2(3)-07B-4(5)0028/ CAPPED (23) HV-2(3)-07B-4(5)0000/ CAPPED (23) HV-2(3)-07B-4(5)0020/ CAPPED (23) HV-2(3)-07B-4(5)0021/ CAPPED (23) HV-2(3)-07B-4(5)0019/ CAPPED (23)	27
				CHK-2(3)-07B-4(5)0095B (1,2,4,5)	AO-2(3)-07B-2(3)523 (1,2,4,5)		
			B	DOUBLE O-RING FOR AO-2(3)-07B-2(3)502A (1,2,4,6) DOUBLE O-RING FOR AO-2(3)-07B-2(3)521B (1,2,4,6)			
			A	DPIS-2(3)503A DPT-9143(26)			

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-206A AND B	INSTR LINE - TORUS LEVEL	M-365	A	LS-2(3)-23-091A LS-2(3)-23-091B LT-8(9)123A LT-8(9)027A LT-8(9)027B		IDV-2-23-91AL/ CAPPED (23,25) IDV-2-23-91AH/ CAPPED (23,25) IDV-2-23-91BL/ CAPPED (23,25) IDV-2-23-91BH CAPPED (23, 25) IDV-2(3)-23B-2(3)1106H/ CAPPED (23) HV-2(3)-23B-2(3)1163L/ CAPPED (23) HV-2(3)-23-2(3)1105H/ CAPPED (23)	
N-207A THRU H	VENT LINE DRAIN	S-54	N/A	PENETRATION INTERNAL TO CONTAINMENT			
N-208A THRU M	ELECTROMATIC RELIEF VALVE DISCHARGE	S-54	N/A	PENETRATION INTERNAL TO CONTAINMENT			
N-209A	AIR AND WATER TEMPERATURE	S-54	A				
N-209B	AIR AND WATER TEMPERATURE	S-54	A				

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-209C	SUPPRESSION CHAMBER THERMOWELL	M-361	A	THERMOWELL			
N-209D	SUPPRESSION CHAMBER THERMOWELL	M-361	A	THERMOWELL			
N-210A	RHR TEST AND POOL COOLING RETURN	M-361	C	WATER SEAL	MO-2(3)-10-034B (1,2,4,5,9,11,16) CHK-2(3)-10-19B (16) CHK-2(3)-10-19D (16)	RTV-2(3)-10A-4(5)072B/ RTV-2(3)-10A-21543B/ SE-4(5)072B (23) HV-2(3)-10-2(3)1540B/ HV-2(3)-10-2(3)1602B/ CAPPED (23)	
			B	WATER SEAL	PACKING FOR MO-2(3)-10-034B (1,2,4,6, 16)	HV-2(3)-10-2(3)1620B/ HV-2(3)-10-2(3)1621B/ CAPPED (23)	
N-210B	RHR TEST AND POOL COOLING RETURN	M-361	C	WATER SEAL	MO-2(3)-10-034A (1,2,4,5,9,11,16) CHK-2(3)-10-19A (16) CHK-2(3)-10-19C (16)	RTV-2(3)-10A-4(5)072A/ RTV-2(3)-10A-21543A/ SE-4(5)072B (23) HV-2(3)-10-2(3)1540A/ HV-2(3)-10-2(3)1602A/ CAPPED (23)	
			B	WATER SEAL	PACKING FOR MO-2(3)-10-034A (1,2,4,6,16)	HV-2(3)-10-2(3)1620A/ HV-2(3)-10-2(3)1621A/ CAPPED (23)	

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-211A	RHR TORUS SPRAY	M-361 M-372	C	MO-2(3)-10-038B (1,2,4,5,9,11,36)	MO-2(3)-10-039B (1,2,4,5,36) MO-2(3)-10-34B (37)	HV-2(3)-10-182B/ HV-2(3)-10-181B/ CAPPED (23)	
				CHK-2-07C-40145 (1,2,4,5,25) CHK-3-07C-50144 (1,2,4,5,26)	SV-2-07C-4951B (1,2,4,5,25) SV-3-07C-5951A (1,2,4,5,26)	HV-2(3)-10-2(3)1597B/ HV-2(3)-10-2(3)1598B/ CAPPED (23) HV-2(3)-07C-4(5)0046/ CAPPED (23) HV-2(3)-07C-4(5)0045/ CAPPED (23)	
			B	PACKING FOR MO-2(3)-10-038B (1,2,4,6) PACKING FOR MO-2(3)-10-034B (1,2,4,6)	PACKING FOR MO-2(3)-10-039B (1,2,4,6)	HV-2(3)-10-2(3)1548B/ HV-2(3)-10-2(3)1549B (23)	

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-211B	RHR TORUS SPRAY	M-361 M-372	C	MO-2(3)-10-038A (1,2,4,5,9,11,36)	MO-2(3)-10-039A (1,2,4,5,36) MO-2(3)-10-034A (37)	HV-2(3)-10-182A/ HV-2(3)-10-181A/ CAPPED (23)	
				CHK-2-07C-40144 (1,2,4,5,25) CHK-3-07C-50145 (1,2,4,5,26)	SV-2-07C-4951A (1,2,4,5,25) SV-3-07C-5951B (1,2,4,5,26)	HV-2(3)-10-2(3)1597A/ HV-2(3)-10-2(3)1598A/ CAPPED (23) HV-2(3)-07C-4(5)0068/ CAPPED (23)	
			B	PACKING FOR MO-2(3)-10-038A (1,2,4,6) PACKING FOR MO-2(3)-10-034A (1,2,4,6)	PACKING FOR MO-2(3)-10-039A (1,2,4,6)	HV-2(3)-07C-4(5)0067/ CAPPED (23) HV-2(3)-10-2(3)1548A/ HV-2(3)-10-2(3)1549A (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-212	RCIC TURBINE EXHAUST	M-359 M-360 M-365	C	WATER SEAL	AO-2(3)-13-137 (1,2,4,5,9,11,16) HV-2(3)-13C-09 (15,16) CHK-2(3)-13C-50 (1,2,4,5,16) MO-2(3)-13C-4(5)244 (1,2,4,5,14,16)	HV-2(3)-13C-2(3)1241/ HV-2(3)-13C-2(3)1242/ CAPPED (23) HV-2-13C-136/ CAPPED/ HV-2-13C-23426 (23,25) HV-3-13C-136/ CAPPED (23, 26) HV-2(3)-13C-52A/ CAPPPED (23)	28
			B	WATER SEAL	O-RING FOR HV-2(3)-13C-09 (1,2,4,6,16)	HV-2(3)-13C-2(3)1203/ HV-2(3)-13C-2(3)1204/ CAPPED (23)	

UFSAR TABLE 5.2.2
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-213A	TORUS DRAIN/TORUS LEVEL	M-365 M-332	A	WATER SEAL	LT-8(9)123B LT-8(9)456 (16)	HV-3-23-31109H/ CAPPED (23)	
			B	WATER SEAL	DOUBLE O-RING FOR FLANGE JOINT (1,2,4,6,16)		
N-213B	TORUS DRAIN	M-332	B	WATER SEAL	DOUBLE O-RING FOR FLANGE JOINT (1,2,4,6,16)		
N-214	HPCI TURBINE EXHAUST	M-365 M-366 M-359	C	WATER SEAL	HV-2(3)-23C-12 (15,16) CHK-2(3)-23C-65 (1,2,4,5,16)	HV-2(3)-23C-2(3)1123/ HV-2(3)-23C-2(3)1124/ CAPPED (23)	28
					AO-2(3)-23C-137 (1,2,4,5,9,11,16)	HV-2(3)-23C-2(3)1126/ CAPPED (23)	
					MO-2(3)-23B-4(5)244A (1,2,4,5,14,16)	HV-2(3)-23C-2(3)1127/ CAPPED (23)	
			B	WATER SEAL	O-RING FOR HV-2(3)-23C-12 (1,2,4,6,16) PACKING FOR HV-2(3)-23C-2(3)1122 (1,2,4,6,16)	HV-2(3)-23C-2(3)1191/ HV-2(3)-23C-2(3)1192/ CAPPED (23) HV-2(3)-23C-2(3)1128/ CAPPED / HV-2(3)-23C-2(3)3427 HV-2(3)-23C-63A/ CAPPED (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-215 UNIT 2	TORUS LEVEL	M-365	A	LT-8456 LT-8123B			25
N-216	HPCI MINIMUM FLOW	M-365	C	WATER SEAL	CHK-2(3)-23B-62 (16)	HV-2(3)-23B-2(3)1121/ CAPPED (23) HV-2(3)-23B-2(3)1145/ CAPPED (23)	
N-217A	SPARE	S-54	A	SEAL WELDED	CHK-2(3)-23C-12 (15)	HV-2(3)-23C-21123 (23)	
N-217B	HPCI AND RCIC VACUUM RELIEF	M-359 M-366 M-365	C	MO-2(3)-23B-4(5)244A (1,2,4,5,14) MO-2(3)-13C-4(5)244 (1,2,4,5,14)	CHK-2(3)-23C-65 (1,2,4,5) AO-2(3)-23-137 (1,2,4,5,9,11) HV-2(3)-13C-09 (15) CHK-2(3)-13C-50 (1,2,4,5) AO-2(3)-13-138 (1,2,4,5,9,11)	HV-2(3)-23C-21124 (23) HV-2(3)-13C-21203 (23) HV-2(3)-13C-21204 (23) HV-2(3)-13C-21241 (23) HV-2(3)-13C-21242 (23) HV-2(3)-23C-52A (23) HV-2(3)-23C-63A (23) HV-2(3)-23C-21126 (23) HV-2(3)-23C-21127 (23)	28
			B		PACKING FOR MO-2-23C-4(5)244A (1,2,4,6,25) O-RING FOR HV-2(3)-13C-09 (1,2,4,6) O-RING FOR HV-2(3)-23C-12 (1,2,4,6) PACKING FOR MV-2(3)-23C-2(3)1122 (1,2,4,6) PACKING FOR MV-2(3)-13C-2(3)1201		

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-218A	INSTRUMENT NITROGEN SUPPLY	M-367	C	CHK-2(3)-16-2(3)3261 (1,2,4,5)	AO-2(3)-16-2(3)968 (1,2,4,5)	HV-2(3)-16-2(3)3305/ HV-2(3)-16-2(3)3306/ CAPPED (23)	
						HV-2(3)-16-2(3)3304/ CAPPED (23)	
N-218B	CACS SAMPLE LINE	M-367	C	SV-2(3)-07D-2(3)671A (1,2,4,5)	SV-2(3)-07D-2(3)978A (1,2,4,5)	HV-2(3)-07D-4(5)0054/ CAPPED (23)	
						HV-2(3)-07D-4(5)0002/ CAPPED (23)	
N-218C	ILRT CONNECTION	M-332	C	HV-2(3)-07A-2(3)9875 (1,2,4,5,13)	HV-2(3)-07A-2(3)9876 (1,2,4,5,13)		
N-219	TORUS PURGE EXHAUST	M-367 M-372	C	AO-2(3)-07B-2(3)513 (1,2,4,5,9,11)	AO-2(3)-07B-2(3)514 (1,2,4,5)	HV-2(3)-07B-4(5)0035/ CAPPED (23)	
				AO-2(3)-07B-2(3)511 (1,2,4,5,9,12)	AO-2(3)-07B-2(3)512 (1,2,4,5) AO-2(3)-07B-8(9)0290 (1,2,4,5)	HV-2(3)-07B-4(5)0036/ CAPPED (23)	
						HV-2(3)-07B-4(5)0013/ HV-2(3)-07B-4(5)0014/ CAPPED (23)	
				SV-2(3)-07D-2(3)671F (1,2,4,5)	SV-2(3)-07D-2(3)978F (1,2,4,5)	HV-2(3)-07D-4(5)0037/ CAPPED (23)	
				SV-2(3)-07E-4(5)960A (1,2,4,5)	SV-2(3)-07E-4(5)961A (1,2,4,5) SV-2(3)-63G-4(5)966A (1,2,4,5) SV-2(3)-63G-8(9)101 (1,2,4,5)	HV-2(3)-07E-4(5)0009/ CAPPED (23)	
						HV-2(3)-07D-4(5)0007/ CAPPED (23)	
			B	DOUBLE O-RING FOR AO-2(3)-07B-2(3)511 (1,2,4,6)			
			A	PT-4(5)952			

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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-220	ILRT SENSORS	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9828 (23) HV-2(3)-07A-2(3)9829 (23)	
N-221	RCIC VACUUM PUMP	M-359	C	WATER SEAL	CHK-2(3)-13C-38 (16)	HV-2(3)-13C-52B/ CAPPED (23)	
N-222	PENETRATION DELETED	S-54					
N-223	HPCI TURBINE DRAIN	M-365	C	WATER SEAL	CHK-2(3)-23C-56 (16)	HV-2(3)-23C-63B/ CAPPED (23)	

UFSAR TABLE 5.2.2
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-224 UNIT 2	CORE SPRAY TEST LINE	M-362	C	WATER SEAL	MO-2-14-026A (16) CHK-2-14-66A (16) CHK-2-14-66C (16) CHK-2-14-29051A (16) CHK-2-10-21541 (16) CHK-2-10-21577A (16)	HV-2-14-29012A (23) RTV-2-14-4073A/ SE-4073A (23)	
N-225	RCIC AND TORUS WATER CLEANUP SUCTION	M-359 M-362	C	WATER SEAL WATER SEAL	MO-2(3)-13-041 (16) MO-2(3)-14-070 (16)		
N-226A	RHR PUMP SUCTION	M-361	C	WATER SEAL	MO-2(3)-10-013B (16) RV-2(3)-10-072B (16)	HV-2(3)-10-2(3)1555B/ CAPPED (23)	
N-226B	RHR PUMP SUCTION	M-361	C	WATER SEAL	MO-2(3)-10-013D (16) RV-2(3)-10-072D (16)	HV-2(3)-10-2(3)1555D/ CAPPED (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-226C	RHR PUMP SUCTION	M-361	C	WATER SEAL	MO-2(3)-10-013A (16) RV-2(3)-10-072A (16)	HV-2(3)-10-2(3)1555A/ CAPPED (23)	
N-226D	RHR PUMP SUCTION	M-361	C	WATER SEAL	MO-2(3)-10-013C (16) RV-2(3)-10-072C (16)	HV-2(3)-10-2(3)1555C/ CAPPED (23)	
N-227	HPCI PUMP SUCTION	M-365	C	WATER SEAL	MO-2(3)-23-058 (16)	HV-2(3)-23B-2(3)1132/ CAPPED (23)	
N-228A Unit 2	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-2-14-007C (16)	HV-2-14-29024C CAPPED (23)	
N-228A Unit 3	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-3-14-007D (16)	HV-3-14-39024D CAPPED (23)	
N-228B Unit 2	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-2-14-007A (16)	HV-2-14-29024A CAPPED (23)	
N-228B Unit 3	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-3-14-007B (16)	HV-3-14-39024B CAPPED (23)	
N-228C Unit 2	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-2-14-007B (16)	HV-2-14-29024B CAPPED (23)	

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CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-228C Unit 3	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-3-14-007C (16)	HV-3-14-39024C CAPPED (23)	
N-228D Unit 2	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-2-14-007D (16)	HV-2-14-29024D CAPPED (23)	
N-228D Unit 3	CORE SPRAY PUMP SUCTION	M-362	C	WATER SEAL	MO-3-14-007A (16)	HV-3-14-39024A CAPPED (23)	
N-229 UNIT 2	CORE SPRAY MINIMUM FLOW	M-362	C	WATER SEAL	CHK-2-14-66B (16) CHK-2-14-66D (16) CHK-2-14A-29036A (16) CHK-2-14A-29036B (16)	HV-2-14-29012B (23)	
N-230	RCIC PUMP MINIMUM FLOW	M-359	C	WATER SEAL	CHK-2(3)-13B-29 (16)		
N-231A UNIT 2	PENETRATION ABANDONED	M-332	A	SEAL WELDED			
N-231A UNIT 3	ELECTRICAL	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-2(3)-07A-2(3)9831A (23) HV-2(3)-07A-2(3)9832A (23)	
N-231B UNIT 2	PENETRATION ABANDONED	M-332	A	SEAL WELDED			

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-231B UNIT 3	ELECTRICAL	M-332	B	DIELECTRIC SEAL (1,2,4,6)		HV-3-07A-39831B (23) HV-3-07A-39832B (23)	
N-232	SPARE	S-54	A	SEAL WELDED			
N-233 UNIT 2	HPCI & RCIC TEST LINE	M-365	C	WATER SEAL	MO-2-23-031 (16)		
N-234 UNIT 2	CORE LINE TEST LINE	M-362	C	WATER SEAL	MO-2-14-026B (16) CHK-2-21-40252 (16) CHK-2-10-21577B (16) CHK-2-14-29051B (16)	HV-2-21-40243/ CAPPED (23) RTV-2-14-4073B/ SE-4073B (23)	
N-234A UNIT 3	CORE LINE TEST LINE	M-362	C	WATER SEAL	MO-3-14-026B (16) CHK-3-14-39051B (16) CHK-3-10-31541 (16) CHK-3-10-31577B (16)	RTV-3-14-5073B/ SE-5073B (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
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PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-234B UNIT 3	CORE SPRAY TEST LINE	M-362	C	WATER SEAL	MO-3-14-026A (16) CHK-3-14-39051A (16) CHK-3-21-50252 (16) CHK-3-10-31577A (16)	HV-3-21-50243/ CAPPED (23)	
N-235 UNIT 3	HPCI & RCIC TEST LINE	M-365	C	WATER SEAL	MO-3-23-031 (16)		
N-236A UNIT 3	CORE SPRAY PUMP MINIMUM FLOW	M-362	C	WATER SEAL	CHK-3-14-66B (16) CHK-3-14-66D (16)	HV-3-14-39012B (23)	

UFSAR TABLE 5.2.2
CONTAINMENT PENETRATIONS
COMPLIANCE WITH 10CFR50, APPENDIX J

PENETRATION NUMBER	DESCRIPTION	DRAWING	TEST TYPE	INBOARD BARRIER (NOTES)	OUTBOARD BARRIER (NOTES)	PASSIVE DEVICES (22) (NOTES)	ADDITIONAL NOTES
N-236B UNIT 3	CORE SPRAY PUMP MINIMUM FLOW	M-362	C	WATER SEAL	CHK-3-14-66A (16) CHK-3-14-66C (16) CHK-3-14A-39036A (16) CHK-3-14A-39036B (16)	HV-3-14-39012A (23)	
N-250 UNIT 2	TEST NOZZLE	M-332	B	DOUBLE O-RING FOR FLANGE JOINT (1,2,4,6)			
N-250 UNIT 3	INSTR LINE - TORUS LEVEL	M-365 M-332	A	LT-9456 LT-9123B			
			B	DOUBLE O-RING FOR FLANGE JOINT (1,2,4,6)			

NOTES FOR TABLE 5.2.2

1. Minimum test duration for all valves and penetrations listed is 20 minutes.

2. Test pressure is at least 49.1 psig for all valves and penetrations except MSIV's which are tested at 25 psig.

3. MSL acceptable leakage for is 150 (maximum) scfh/line of air or 300 scfh for all 4 MSLs.

4. The total acceptable leakage for all valves and penetrations is 0.60 La.

5. Local leak tests on all testable isolation valves shall be performed per 10CFR50, Appendix J requirements.

6. Local leak tests on all testable penetrations shall be performed per 10CFR50, Appendix J requirements.

7. Personnel Air Locks shall be tested at intervals per 10CFR50, Appendix J requirements.

8. The Personnel Air Locks are tested at a pressure of at least 49.1 psig.

9. Identifies isolation valves that may be tested by applying pressure between the inboard and outboard valves.

10. Gate valves which may be tested in the reverse direction. Test acceptable since the normal force between the seat and the disc generated by stem action alone is greater than ten (10) times the normal force induced by test differential pressure except for valves MO-2(3)-10-031A,B which is 7.97. This applies to the following valves:

MO-2(3)-01A-074	MO-2(3)-10-031A,B	MO-2(3)-13-015
MO-2(3)-10-018	MO-2(3)-23-015	MO-2(3)-12-015

11. Globe valves which may be tested in the reverse direction. Test acceptable since the test pressure is applied under the valve seat. This applies to the following valves:

AO-2(3)-01A-080A-D		AO-2(3)-13-137
AO-2(3)-20-094	AO-2(3)-23-137	AO-2(3)-07B-2(3)509
MO-2(3)-10-038A,B	AO-2(3)-02-039	MO-2(3)-10-034A,B
AO-2(3)-02-316	AO-2(3)-20-082	AO-2(3)-07B-2(3)513
HV-2(3)-36A-2(3)0165		

NOTES FOR TABLE 5.2.2 (cont.)

12. Butterfly valves which may be tested in the reverse direction. Test acceptable since valve is equipped with inflatable seal which provide equivalent bi-directional sealing (Reference Standard ANSI/ANS-56.8-2002, Section 6.2, "Direction of Seating"). This applies to the following valves:

AO-2(3)-07B-2(3)520	AO-2(3)-07B-2(3)506	AO-2(3)-07B-2(3)511
AO-2(3)-07B-2(3)521B	AO-2(3)-07B-2(3)502A	AO-2(3)-07B-2(3)519

13. Manual globe valves which may be tested in the reverse direction. This applies to the following valves:

HV-2(3)-07A-2(3)9871	HV-2(3)-07A-2(3)9872	HV-2(3)-07A-2(3)9873
HV-2(3)-07A-2(3)9874	HV-2(3)-07A-2(3)9875	HV-2(3)-07A-2(3)9876

These valves are locked closed except during ILRT's.

14. Gate valve utilized for containment isolation in both directions. Test performed only in one direction. Valve normal force ratio is 17.9. Leakage path is between separate torus penetrations only.

15. These stop-check valves serve as block valves to allow testing of the outboard check valve. The check function of these valves is not leak tested. This applies to the following valves:

HV-2(3)-13C-09
HV-2(3)-23C-12

16. These lines discharge below the minimum torus water level and will thus have a water seal after an accident. Therefore, 10CFR50, Appendix J testing for the identified device is not required due to this component.

17. The CRD insert and withdrawal lines are demonstrated to be water filled post-accident. Therefore, the CRD insert and withdraw lines are not a 10CFR, Appendix J pathway, and no 10CFR50, Appendix J testing is required.

18. The TIP shear valves are not Type C tested because squib detonation is required for closure. This is an exemption to 10CFR50, Appendix J. These valves are located in small diameter (3/8") tubing lines. The possible leakage paths which include these valves are tested during Type A (ILRT) tests.

19. Explosive valve may be tested in the reverse direction. Valve is normally closed and opens only on SLCS actuation.

NOTES FOR TABLE 5.2.2 (cont.)

20. Inboard manual gate valve may be tested in the reverse direction. Valve is locked closed except during refueling outages when containment breathing air is required.

21. Butterfly valves which may be tested in the reverse direction. Test acceptable since valve provides equivalent bi-directional sealing. This applies to the following valves:

    AO-2(3)-07B-2(3)502B

22. Passive devices are isolation barriers installed in branch lines (e.g. vent lines, drain lines, and test connections) connected to the process line between the outside of the containment and the inboard isolation barrier or between the inboard and outboard isolation barriers. Component numbers separated by a slash (/) are installed in a single branch line.

23. Passive devices are exempt from Technical Specification Surveillance Requirement SR 3.6.1.3.4 based on line size.

24. These penetrations are for the vent lines which connect the Drywell structure to the Torus structure and leakage is tested during Type A (ILRT) tests.

25. Unit 2 only.

26. Unit 3 only.

27. Penetrations N-25 and N-205B utilize common isolation valves.

28. Penetrations N-212, N-214, and N-217B utilize common isolation valves.

29. Passive devices are located inside containment.

30. Component identifier containing XX refers to HCU bank identifier.

31. Passive devices are located in a high radiation area during plant operation.

32. ANSI 56.8, 1984 – 6.2(2) permits testing in either direction for globe valves inside or outside of containment.

33. This penetration only requires one PCIV. The shear valve (XV) and ball valve (SV) work in tandem to fulfill the PCIV function.

NOTES FOR TABLE 5.2.2 (cont.)

34. The isolation provisions for this penetration consist of two isolation valves and a closed system outside containment. Because a closed system outside containment is maintained in these lines, Appendix J Type C testing for the identified device is not required.

35. When the XV-2(3)-11-14A,B valves are closed, the inboard isolation barrier for penetration N-42 is CHK-2(3)-11-16 and the outboard barrier is XV-2(3)-11-14A,B. Once the XV-2(3)-11-14A,B valve is opened, the CHK-2(3)-11-16 moves to the outboard barrier and a qualified water seal is credited as the inboard barrier.

36. The isolation provisions for this penetration consist of two isolation valves and a water filled closed system outside containment. Therefore, 10 CFR 50, Appendix J Type C testing for the identified device is not required since they do not constitute a potential primary containment atmospheric pathway.

37. MO-2(3)-10-034A and MO-2(3)-1034B are boundary valves for the local leakage rate testing of MO-2(3)-10-38A, MO-2(3)-10-38B, MO-2(3)-10-39A and MO-2(3)-10-39B, penetrations N-211A and N-211B. See N-210A and N-210B for the testing exemption for MO-2(3)-10-34A and MO-2(3)-10-34B.

5.3 SECONDARY CONTAINMENT SYSTEM

5.3.1 Reactor Building

5.3.1.1 Safety Objective

The safety objective of the reactor building secondary containment, in conjunction with other engineered safeguards, is to limit the ground level release of airborne radioactive materials and to provide means for controlled elevated release of the building atmosphere so that off-site doses from the postulated design basis accidents are below the values of 10 CFR 50.67.

5.3.1.2 Safety Design Basis

1. The reactor building provides secondary containment by enclosing the reactor, its primary containment, refueling floor, and equipment necessary for safe plant shutdown. It provides containment (as required) when the primary containment is open.

2. The reactor building shall withstand internal pressures of up to 7 inches water gauge. Pressures in excess of this are relieved.

3. The reactor building shall withstand an environmental event, such as earthquake, without loss of structural integrity.

4. The reactor building shall withstand horizontal missiles generated by a tornado or by internal missiles from a failure of rotating equipment, such as the turbine-generator or a pump, to the extent that safeguards equipment located inside the building is protected.

5. The reactor building is provided with means to conduct leakage tests.

5.3.1.3 Description

The structural design features of the reactor building, which include the design for earthquakes, tornados, flooding, missiles, and other considerations, are discussed in Section 12.0, "Structures and Shielding," and Appendix C.

The reactor building is founded on a rock formation as described in subsection 2.7, "Foundation Analysis."

The interior and exterior walls of the reactor building are cast-in-place concrete from the foundation to the refueling floor. The superstructure above the refueling floor is metal siding and decking on a structural steel framework. The thicknesses of the concrete walls are governed by their structural or shielding requirements.

The insulated metal siding above the refueling floor is installed with sealed joints.

The penetrations for piping, ventilation ducts, electrical cables, and instrument leads are sealed. The ventilation ducts are provided with valves for automatic closure when reactor building isolation is required.

The reactor building has personnel and equipment entrances. The entrances are provided with airtight doors forming an airlock system to maintain the leaktightness of secondary containment.

Each secondary containment personnel access door is equipped with a position switch to support a monitoring system, which consists of local indicating lights, a local audible alarm, and main control room (MCR) annunciator lights and alarms. When one inner door or one outer door is opened, the indicating lights above the opposing doors that are closed are lit to warn against opening. When both an inner and an outer door are opened, the indicating lights above each door are lit, an instantaneous audible alarm is annunciated, and after a 10 second delay, an MCR alarm is annunciated to identify that secondary containment has been breached, and personnel are dispatched to investigate.

The preset time delay of 10 seconds for an MCR alarm due to an inadvertent, simultaneous opening of secondary containment personnel access doors is based on the following considerations:

a) It is limited to the time it takes to traverse through a door, typically less than 10 seconds.

b) In the safety analysis for a loss-of-coolant accident coincident with a loss of offsite power, the Standby Gas Treatment (SGT) system does not start until 16 seconds after the start of the event.

c) The simultaneous opening time does not impact the SGT system draw down time. The draw down time analysis takes no credit for any differential pressure (vacuum) for the secondary containment initial condition.

d) The dose analysis assumes that secondary containment will be drawn to the required vacuum condition at 180

seconds. Surveillance testing verifies that this can be performed by each train of the SGT system.

5.3.2 Reactor Building Heating and Ventilating System

5.3.2.1 Power Generation Objective

The power generation objective of the reactor building heating and ventilation system is to provide suitable environmental conditions for personnel and equipment. Additionally, in some areas the system provides protection for personnel against airborne radioactive contaminants.

5.3.2.2 Power Generation Design Basis

1. The system provides appropriate ambient temperature conditions for plant operating personnel and equipment.

2. The system provides sufficient filtered fresh air for personnel.

5.3.2.3 Safety Design Basis

1. The system permits leaktight secondary containment upon receipt of isolation signals.

2. The system provides ventilation in the engineered safeguards rooms using either normal or emergency power supplies.

3. The system circulates air from areas of lesser contamination to areas of potentially greater contamination prior to exhaust.

5.3.2.4 Description

The reactor building is separated into two ventilation areas, the area above the refueling floor and the area below the refueling floor. Each area is provided with ventilation supply and exhaust systems. The system employs once-through ventilation without recirculation. Exhaust air is discharged to atmosphere through the ventilation stack at the reactor building roof (Drawings M-388 and M-391).

The refueling floor zone ventilation system is normally served by two half-capacity supply and two half-capacity exhaust fans. The ventilation system supplies filtered and tempered outdoor air from one side of the refueling floor and exhausts from the opposite wall and roof of the area. Ventilation slots are provided at water level in the fuel pool, reactor cavity, and steam dryer-

separator storage pool side walls for exhausting radioactive particulates which might become airborne.

The reactor building area below the refueling floor is provided with a ventilation supply system, an area ventilation exhaust system, and an equipment compartment exhaust system. Filtered and tempered outdoor air is routed from areas of lesser to areas of potentially greater contamination prior to exhaust. The ventilation exhaust from contaminated equipment compartments and tank vents is passed through a high-efficiency filter system prior to release to the ventilation stack.

The core standby cooling pump compartments in the lower elevations of the reactor building are normally ventilated by the reactor building ventilation system. Supplementary cooling is provided by fan-coil units installed in the pump rooms when the core cooling pumps are running. Each pump room is provided with two fan-coil units. Each cooler by itself can remove 100% of the required room heat load. One is maintained operational, and with the exception of 3CE058, one is provided as an installed spare. The fan unit for the 3C RHR Component Room Cooler 3CE058 is installed spare, without a dedicated power source. The cooling coil of the operational unit is served by the emergency service water system and the power supply to the associated fan is provided from the standby power supply during loss of offsite power. The spare cooler is normally isolated mechanically and electrically.

An analysis has determined that the RHR subsystems can still perform their design function even if emergency service water / service water is not available to the RHR fan-coil units during shutdown conditions (Modes 4 and 5) with RHR suction temperature less than 110°F.

Allowable temperatures in the HPCI and RCIC pump compartments have been established to permit HPCI and RCIC operability without operation of normal or supplementary room cooling.

Each duct connecting to the outside atmosphere is provided with fast-acting, cylinder-operated, butterfly valves for isolation.

Radiation monitors are installed in both the refueling floor exhaust duct and the reactor building exhaust system duct which serves the area below the refueling floor. Duct isolation valve closure time is 3 to 10 sec. The monitors for the refueling floor exhaust duct are located after the last exhaust branch duct and at a distance equivalent to or better than exhaust air travel time from the monitors to the isolation valve. For the reactor building area ventilation exhaust duct, no such delay is incorporated since there are no consequences associated with such an accidental release over the 3 to 10-sec valve closure because

the gap activity release starts at 120 sec after onset of a DBA LOCA. During non-LOCA accidents, the release starts instantaneously with the onset of the damage. The signal that causes isolation of the reactor building also actuates the standby gas treatment system. This signal is initiated by one of the following conditions:

1. Reactor vessel low water level.

2. Drywell high pressure.

3. Reactor building exhaust ventilation duct high radiation (subsection 7.12, "Process Radiation Monitoring").

4. Manual initiation.

5.3.3 Standby Gas Treatment System

5.3.3.1 Safety Objective

The safety objective of the standby gas treatment system is to limit the ground level release from the reactor building, and to release primary and secondary containment air at an elevated release point via the main stack. An additional objective is support of maintenance, testing, and operations activities such as drywell purging, without any loss of safety function.

5.3.3.2 Safety Design Basis

1. The system limits the release of radioactive materials by maintaining a negative pressure in the reactor building under normal atmospheric conditions.

2. The system filters the exhaust air to remove radioactive particulates and halogens. The filtration is not credited for Design Basis Accidents utilizing AST Methodology.

3. The power supplies to the system provide uninterrupted operation.

4. The system maintains its functional integrity in the event of an earthquake.

5. The system is provided with means to test system performance.

6. The system is designed to support containment atmospheric dilution by providing a filtered flow path for purging primary containment post-LOCA.

5.3.3.3 Description

The standby gas treatment system is common to both Units 2 and 3 and is located in a shielded room in the radwaste building between the reactor buildings (Drawings M-388, M-391 and M-397).

The standby gas treatment system consists of two parallel filter trains connected to three full-capacity exhaust fans. Each filter train is sized to treat a gas flow at a rated flow of 10,500 CFM. Each fan is capable of exhausting the rated flow through either filter train and up through the main stack.

Each filter train consists of the following components in series:

1. A moisture separator to remove entrained water droplets.

2. An electric resistance heater to lower the humidity of the air stream before it enters the filters. These heaters are provided to maintain the relative humidity below 70%.

3. A water resistant prefilter to remove dust and lint.

4. A water resistant, high-efficiency filter, capable of removing 99.97 percent of 0.3-micron diameter particles.

5. A charcoal filter to remove iodine, capable of removing 99.9 percent elemental iodine and 95 percent methyl iodide.

6. A high-efficiency filter to remove charcoal dust or particulates which may penetrate the charcoal bed.

The standby gas treatment plenums are of welded steel construction arranged for isolation, maintenance, and testing. A fire protection system is provided at the charcoal filter trays.

The standby gas treatment system uses the normal reactor building ventilation system exhaust piping and duct work. Two exhaust lines from each reactor building connect to the common filter train inlet plenum. One line is connected to the reactor building refueling floor ventilation exhaust duct, and the other is connected to reactor building air spaces below the refuel floor

and the torus and drywell. Automatically actuated valves are provided with the system.

5.3.4 Safety Evaluation

The environmental effects of postulated design basis accidents are minimized by the reactor building heating and ventilating and standby gas treatment systems. Upon a reactor building isolation signal, the reactor building ventilation isolation valves isolate the reactor building atmosphere in 3 to 10 sec*. This rapid closure time prevents escape of potentially contaminated air. At the same time, the standby gas treatment system is automatically started to maintain a negative pressure in the reactor building. Potentially contaminated air from the reactor then passes through the standby gas treatment system for filtration prior to elevated release from the stack.

The standby gas treatment system will remain functional under earthquake conditions.

Release of radioactivity via the standby gas treatment system for various postulated accidents is analyzed in Section 14.0, "Safety Analysis."

The standby gas treatment system is designed to maintain the reactor building pressure at a negative 1/4 inch water gauge pressure with a flow rate of not more than 10,500 cfm. At this flow rate, the offsite dose is well within 10 CFR 50.67 limits as shown by the analysis in Section 14.9.2. One of the assumptions in the analysis in Section 14.9.2 is that escaping fission products immediately flow through the SGTS and the stack without mixing in the secondary containment building and without crediting filtering through charcoal and HEPA filters. This assumption is equivalent to assuming a zero holdup time and no filtration credit for the fission products, which results in conservative dose consequences. This assumption is equivalent to assuming a zero holdup time for the fission products, which results in a higher release rate to the environs. Therefore, the analysis in Section 14.9.2 results in calculated offsite dose levels that are higher than the dose level that would be obtained if the analysis assumed the allowable reactor building leakage in the Technical Specification (10,500 cfm).

*Except for the isolation valves associated with the drywell purge supply portion of the reactor building ventilation isolation (AO-20459, AO-20460, AO-30459, and AO-30460) which isolate in 1.5 to 10 seconds.

5.3.5 Inspection and Testing

The reactor building leakage rate is tested by isolating the building and operating the standby gas treatment system. The standby gas treatment system modulating dampers are adjusted to obtain negative pressure in the reactor building. The rate at which air is exhausted through the system, as measured by the flow indicator, indicates building in-leakage.

Provisions are made for testing each filter unit. These tests include determinations of differential pressure across each filter and filter efficiency. Connections for testing, such as injection and sampling, are located to provide adequate mixing of the injected fluid and representative sampling and monitoring, so that test results are indicative of performance. A halogenated hydrocarbon system is used to test the activated charcoal filters, and a dioctylphthalate (DOP) system is used to test the high-efficiency filters in place.