

5. Pressure Suppression Chamber - Drywell Vacuum Breakers

- a. When primary containment is required, all suppression chamber - drywell vacuum breakers shall be OPERABLE except during testing and as stated in Specification 3.5.A.5.b and c, below. Suppression chamber - drywell vacuum breakers shall be considered OPERABLE if:
- (1) The valve is demonstrated to open from closed to fully open with the applied force at all valve positions not exceeding that equivalent to 0.5 psi acting on the suppression chamber face of the valve disk.
 - (2) The valve disk will close by gravity to within not greater than 0.10 inch of any point on the seal surface of the disk when released after being opened by remote or manual means.
 - (3) The position alarm system will annunciate in the control room if the valve is open more than 0.10 inch at any point along the seal surface of the disk.
- b. Five of the fourteen suppression chamber - drywell vacuum breakers may be inoperable provided that they are secured in the closed position. With one of the nine required suppression chamber - drywell vacuum breakers inoperable, restore one vacuum breaker to OPERABLE status within 72 hours.
- c. One position alarm circuit for each OPERABLE vacuum breaker may be inoperable, provided that each OPERABLE suppression chamber - drywell vacuum breaker with one defective alarm circuit, and associated remaining position alarm circuit are verified to be OPERABLE immediately, and monthly in accordance with 4.5.F.5.a. Additionally, a daily verification using the OPERABLE position alarm circuit that the affected vacuum breaker is closed shall be performed.
- d. If Specifications 3.5.A.5 (a), (b) or (c) can not be met, the reactor shall be PLACED IN the COLD SHUTDOWN CONDITION within 24 hours.

6. After completion of the startup test program and demonstration of plant electrical output, the primary containment atmosphere shall be reduced to less than 4.0% O₂ with nitrogen gas within 24 hours after the reactor mode selector switch is placed in the RUN MODE. Primary containment deinerting may commence 24 hours prior to a scheduled shutdown.

7. Deleted.

The capacity of the 14 suppression chamber to drywell vacuum relief valves is sized to limit the external pressure of the drywell during post-accident drywell cooling operations to the design limit of 2 psi. They are sized on the basis of the Bodega Bay pressure suppression tests⁽⁹⁾⁽¹⁰⁾. A calculation⁽¹⁵⁾ was performed in accordance with NEDE-24802⁽¹⁶⁾ to determine the required number of vacuum breakers by using a mass and energy balance to determine vacuum breaker flow area. The results of the calculation indicate that 8 vacuum breakers are required to provide vacuum relief capability. An additional vacuum breaker is included for single failure criteria, bringing the total required to 9.

Each suppression chamber drywell vacuum breaker is fitted with a redundant pair of limit switches to provide fail safe signals to panel mounted indicators in the reactor building and alarms in the control room when the disks are open more than 0.1" at any point along the seal surface of the disk. These switches are capable of transmitting the disk closed-to-open signal with 0.01" movement of the switch plunger. Continued reactor operation with failed components is justified because of the redundancy of components and circuits and, most importantly, the accessibility of the valve lever arm and position reference external to the valve. The fail-safe feature of the alarm circuits assures operator attention if a line fault occurs.

Conservative estimates of the hydrogen produced, consistent with the core cooling system provided, show that the hydrogen air mixture resulting from a loss-of-coolant accident is considerably below the flammability limit and hence it cannot burn, and inerting would not be needed. However, inerting of the primary containment was included in the proposed design and operation. The 5% oxygen limit is the oxygen concentration limit stated by the American Gas Association for hydrogen-oxygen mixtures below which combustion will not occur.⁽⁴⁾ The 4% oxygen limit was established by analysis of the Generation and Mitigation of Combustible Gas Mixtures in Inerted BWR Mark I Containments.⁽¹²⁾

To preclude the possibility of starting up the reactor and operating a long period of time with a significant leak in the primary system, leak checks must be made when the system is at or near rated temperature and pressure. It has been shown⁽⁹⁾⁽¹⁰⁾ that an acceptable margin with respect to flammability exists without containment inerting. Inerting the primary containment provides additional margin to that already considered acceptable. Therefore, permitting access to the drywell for the purpose of leak checking would not reduce the margin of safety below that considered adequate and is judged prudent in terms of the added plant safety offered by the opportunity for leak inspection. The 24-hour time to provide inerting is judged to be a reasonable time to perform the operation and establish the required O₂ limit.

Two separate filter trains are provided, each having 100% capacity⁽⁶⁾ If one filter train becomes inoperable, there is no immediate threat to secondary containment and reactor operation may continue while repairs are being made. Since the test interval for this system is one month (Specification 4.5), the time out-of-service allowance of 7 days is based on considerations presented in the Bases in Specification 3.2 for a one-out-of-two system.

Two automatic secondary containment isolation valves are installed in each reactor building ventilation system supply and exhaust duct penetration. Both isolation valves for each supply duct penetration are located inside the secondary containment boundary, and the two exhaust duct penetration isolation valves are located outside of the secondary containment boundary. Removal of an inboard supply or exhaust valve (closest to the boundary) is permitted only when secondary containment is not required. The outboard isolation supply or exhaust valve can be removed when secondary containment is required as long as the inboard valve is secured in the closed position.

- References:
- (1) FDSAR, Volume I, Section V-1
 - (2) FDSAR, Volume I, Section V-1.4.1
 - (3) FDSAR, Volume I, Section V-1.7
 - (4) Licensing Application, Amendment 11, Question III-25
 - (5) FDSAR, Volume I, Section V-2
 - (6) FDSAR, Volume I, Section V-2.4
 - (7) Licensing Application, Amendment 42
 - (8) Licensing Application, Amendment 32, Question 3
 - (9) Robbins, C. H., "Tests on a Full Scale 1/48 Segment of the Humboldt Bay Pressure Suppression Containment," GEAP-3596, November 17, 1960.
 - (10) Bodega Bay Preliminary Hazards Summary Report, Appendix I, Docket 50-205, December 28, 1962.
 - (11) Report H. R. Erickson, Bergen-Paterson To K. R. Goller, NRC, October 7, 1974. Subject: Hydraulic Shock Sway Arrestors.
 - (12) General Electric NEDO-22155 "Generation and Mitigation of Combustible Gas Mixtures in Inerted BWR Mark I Containment" June 1982.
 - (13) Oyster Creek Nuclear Generating Station, Mark I Containment Long-Term Program, Plant Unique Analysis Report, Suppression Chamber and Vent System, MPR-733; August, 1982.
 - (14) Oyster Creek Nuclear Generating Station, Mark I Containment Long-Term Program, Plant Unique Analysis Report, Torus Attached Piping, MPR-734; August, 1982.
 - (15) AmerGen Calculation C-1302-243-E170-087, "Wetwell-to-Drywell Vacuum Breaker Sizing."
 - (16) General Electric NEDE-24802, "Mark I Containment Program Mark I Wetwell-to-Drywell Vacuum Breaker Functional Requirements, Task 9.4.3," April, 1980.