C. Containment Purge Supply and Exhaust Valves

The containment purge supply and exhaust valves shall be locked closed and may not be opened unless the reactor is in the cold shutdown or refueling shutdown condition.

a. One of the redundant valves in the purge supply and exhaust lines may be opened to perform the repairs required to conform with TS 15.4.4.II.B. The time duration and shutdown requirements of TS 15.4.4.II.B.2 shall be applied.

Basis

The Reactor Coolant System conditions of cold shutdown assure that no steam will be formed and hence there would be no pressure buildup in the containment if the Reactor Coolant System ruptures.

The shutdown conditions of the reactor are selected based on the type of activities that are being carried out. When the reactor head is not to be removed, the specified cold shutdown margin of 1% $\Delta K/K$ precludes criticality under any occurrence. During refueling the reactor is subcritical by 10% $\Delta K/K$. This precludes criticality under any circumstances even though fuel is being moved or control rods withdrawn. Positive reactivity addition by rod motion from an initial 10% $\Delta K/K$ subcritical reactor condition precludes criticality because the reactor would be substantially subcritical even if all control rods were completely withdrawn. Positive reactivity changes by boron dilution may be required or small fluctuations may occur during preparation for, recovery from, or during refueling but maintaining the boron concentration greater than 1800 ppm precludes criticality under any circumstances. Should continuous dilution occur, the time intervals for this incident are discussed in Section 14.1.5 of the FFDSAR.

Regarding internal pressure limitations, the containment design pressure of 60 psig would not be exceeded if the internal pressure before a major loss-of-coolant accident were as much as 6 psig.[1] The containment is designed to withstand an internal vacuum of 2.0 psig.[2]

The containment purge supply and exhaust valves are required to be locked closed during plant operations since these valves have not been demonstrated capable of closing from the full open position during a design basis loss-of-coolant

15.4.4 CONTAINMENT TESTS

Applicability

Applies to containment leakage and structural integrity.

Objective

To verify that potential leakage from the containment and the pre-stressing tendon loads are maintained within acceptable values.

Specification

I. Type A Periodic Integrated Leakage Rate Test

A. Test

1. The Type A periodic in-service integrated leakage rate test shall be performed at intervals specified in I-C below at an initial pressure P_t at or above 30 psig (50% of design pressure (P_a)).
2. Test accuracy shall be verified by supplementary means such as measuring the quantity of air required to return to the starting pressure (P_t) or by imposing a known leak rate to demonstrate the validity of measurements.
3. Closure of the containment isolation valves for the purpose of the test shall be accomplished by the means provided for normal operation of the valves without preliminary exercises or adjustment. Repairs of maloperating or leaking valves shall

be made as necessary. Description of valve closure malfunction or valve leakage that requires corrected action before the test shall be included in the Test Report.

4. Leak repairs, if required during the integrated leakage test, shall be preceded and followed by local leakage rate measurements. A description of the repairs and the the leakage rates measured prior to and after the repairs shall be included in the Test Report.

5. The test duration shall not be less than 24 hours unless the criteria listed in "a" or "b" below are met.

   a. For the Absolute Method, Mass Point technique, the test duration may be shortened to less than 24 hours provided the following EPRI Project 1393-5 acceptance criteria for short duration testing are met:

      1) Use the absolute method, mass point technique.

      2) The containment must be accurately modeled by at least one of the following conditions:

         i. The containment temperature must be modeled with a minimum of 18 resistance temperature detectors (RTD's).

         ii. Accurate and validated temperature weighting factors must be utilized.

         iii. The average temperature change must be less than 0.5°F/HR during the duration of the ILRT.

      3) The 95 percent upper confidence level leakage rate must be zero or a positive value.

      4) The calculated least square fit (LSF) leakage must be less than .75 of the allowable leakage rate criteria at test pressure as specified in 15.4.4.I.B.

      5) The calculated 95% confidence level must be less than .75 of the allowable leakage rate criteria at test pressure as specified in 15.4.4.I.B.

6) The calculated LSF leakage rate as a function of time shall have stabilized with a negligible positive or negative slope, as demonstrated by the following:

$$\left| \frac{(L_n - L_{n-i}) \times 100}{(t_n - t_{n-i})\ (L_c - L_n)} \right| \leq 10$$

Where L_n = Final test point LSF leakage rate

L_{n-i} = Leakage rate for data points taken within previous hour

t_n = Time in hours of the last data point

t_{n-i} = Time in hours for the data point used for L_{n-i}

L_c = Test leakage criteria (75% of allowable leakage at test pressure)

7. The calculated 95% upper confidence level leakage rate shall be converging with the LSF leakage rate, defined as follows:

Define: $D_i = L_{95,i} - L_{LSF,i}$

Require: $D_{i-1} \geq D_i$ for all i during the last test hour

b. For the Absolute Method, Total Time technique, the test duration may be shortened to less than 24 hours provided the following Bechtel Corporation Topical Report (BN-TOP-1) acceptance criteria for short duration testing are met:

1) For the containment atmosphere stabilization:
Once the containment is at test pressure the containment atmosphere shall be allowed to be stabilize for about four hours. The atmosphere is considered stabilized when:

i. The rate of change of average temperature is less than 1.0°F/hour/hour averaged over the last two hours.

or

ii. The rate of change of temperature changes less than 0.5°F/hour/hour averaged over the last two hours.

2) For the data recording and analysis, using the absolute method, Total Time technique:

   i. The Trend Report based on Total Time calculations shall indicate that the magnitude of the calculated leak rate is trending to stabilize at a value less than the maximum allowable leak rate (L_a).

      (Note: The magnitude of the calculated leak rate may be increasing slightly as it tends to stabilize. In this case, the average rate shall be determined from the accumulated data over the last five hours or last twenty data points, whichever provides the most points. Using this average rate, the calculated leak rate can then be linearly extrapolated to the 24th hour data point. If this extrapolated value of the calculated leak rate exceeds 75% of the maximum allowable leak rate (L_a) then the leak rate test is continued.)

      and

   ii. The end of test upper 95% confidence limit for the calculated leak rate based on Total Time calculations shall be less than the maximum allowable leak rate.

      and

   iii. The mean of the measured leak rates based on Total Time calculations over the last five hours of test or last twenty data points, whichever provides the most data, shall be less than the maximum allowable leak rate.

      and

   iv. Data shall be recorded at approximately equal intervals and in no case at intervals greater than one hour.

      and

   v. At least twenty data points shall be provided for proper statistical analysis.

      and

vi. In no case shall the minimum test duration be less than six hours.

B. Acceptance Criteria

1. The governing criteria for acceptance of peak pressure tests is that the maximum allowable leakage (L_a) shall not exceed 0.40 weight percent per day of containment atmosphere at 60 psig (P_a) which is the design pressure.

2. The allowable in-service leakage rate (L_t) at the reduced test pressure (P_t) shall not exceed $L_a(L_{tm}/L_{am})$, except if L_{tm}/L_{am} is greater than 0.7, L_t shall be equal to $L_a(P_t/P_a)1/2$. Where: L_a is the maximum allowable leakage rate at pressure P_a for the preoperational tests; the subscript 'm' refers to values of the leakage measured during initial preoperational tests; and the subscripts 'a' and 't' refer to tests at accident pressure and reduced test pressure, respectively.

3. The measured leakage rate (L_{tm}) for in-service test shall not exceed 0.75 L_t, as determined under B-1 above.

b. Airlock and equipment door seals, including operating mechanism and penetrations with resilient seals which are part of the containment boundary in the airlock structure.

c. Fuel transfer tube flange seal.

d. The containment purge supply and exhaust valves.

e. Other containment components which require leak repair in order to meet the acceptance criterion for any integrated leakage rate test.

B. <u>Acceptance Criterion</u>

1. The total leakage from items II.A.5 and III.A.3 shall not exceed $0.6\ L_a$.

   a. If at any time it is determined that $0.6\ L_a$ is exceeded, repairs shall be initiated immediately. After repair, a retest to confirm conformance to the acceptance criterion of II.B. is required.

   b. If repairs are not completed and conformance to the acceptance criterion of II.B. is not demonstrated within 48 hours, the reactor shall be taken to cold shutdown conditions until repairs are effected and the local leakage meets this acceptance criterion.

2. The leakage from the airlock doors seal test, resulting from the 3 day testing requirement in II.C.1.d, shall be considered acceptable if the leakage sum from the worst door in each airlock, extrapolated to P_a, and added to the total of items II.A.5 and III.A.3, is less than $0.6\ L_a$.

   a. If the total identified in II.B.2, above, exceeds $0.6\ L_a$, then the airlock containing the worst door shall be full pressure tested to determine the actual leakage performance.

3. The leakage rate for the containment purge supply and exhaust valves shall be compared to the previously measured leakage rate to detect excessive valve degradation.

C. <u>Test Frequency</u>

1. Individual penetrations shall be tested during each shutdown for major fuel reloading except as specified in a and b below. In no case shall the interval be greater than two years.

   a. The containment equipment hatch flange seals and the fuel transfer tube flange seals shall be tested at each shutdown for major fuel reloading or after each time used, if that be sooner.

b. The air locks shall be tested at 6-month intervals at test pressure not less than P_a.

c. Personnel airlocks shall be tested at a pressure of no less than P_a following periods when containment integrity is defeated through the use of the airlock.

d. Personnel airlocks opened during periods when containment integrity is established shall be tested within 3 days after being opened. Personnel airlocks opened more frequently than once every 3 days shall be tested at least once every 3 days during the period of frequent openings.

e. The containment purge supply and exhaust valves shall be tested at 6-month intervals.

III. Type "C" Tests

A Type "C" test measures the leakage across an individual valve or across a group of valves used to isolate an individual penetration through the primary reactor containment as defined in III.A.3.

A. Test

1. Type "C" tests shall be performed at intervals specified in III.D below and at a pressure of not less than P_a.
2. Acceptable methods of testing are by local pressurization and the methods described in II.A.4 above. The pressure shall be applied in the same direction as that when the valve would be required to perform its safety function, unless it can be determined that the results from the tests for a pressure applied in a different direction will provide equivalent or more conservative results. Each valve to be tested shall be closed by normal operation and without any preliminary exercising or adjustments.

3. Local leakage shall be measured for containment isolation valves that:

   a. Provide a direct connection between the inside and outside atmospheres of the primary reactor containment under normal operation.

   b. Are required to close automatically upon receipt of a containment isolation signal.

   c. Are required to operate intermittently under post-accident conditions.

B. Acceptance Criterion

The total leakage from items II.A.5 and III.A.3 shall not exceed 0.6 L_a.

C. Corrective Action

1. If at any time it is determined that 0.6 L_a is exceeded, repairs shall be initiated immediately. After repair, a retest to confirm conformance to the acceptance criterion of III.B is required.

2. If repairs are not completed and conformance to the acceptance criterion of III.B is not demonstrated within 48 hours, the reactor shall be taken to cold shutdown conditions until repairs are effected and the local leakage meets this acceptance criterion.

D. Test Frequency

1. The above tests of the isolation valves shall be conducted during each shutdown for major fuel reloading but in no case at intervals greater than two years.

E. In addition to the preceding requirements, temperature readings will be obtained at the locations where inward deformations were measured. Temperature measurements will also be obtained on the outside of the containment building wall.

Basis

The containment is designed for an accident pressure of 60 psig.[1] While the reactor is operating, the internal environment of the containment will be air at approximately atmospheric pressure and a temperature of about 105°F. With these initial conditions, the temperature of the steam-air mixture at the peak accident pressure of 60 psig is 286°F.

Prior to initial operation, the containment was strength tested at 69 psig and then leak-tested. The design objective of this pre-operational leakage rate test was established as 0.4% by weight per 24 hours at 60 psig. This leakage rate is consistent with the construction of the containment,[2] which is equipped with independent leak-testable penetrations and contains channels over all containment liner welds, which were independently leak-tested during construction.

Safety analyses have been performed on the basis of a leakage rate of 0.40% by weight per 24 hours at 60 psig. With this leakage rate and with minimum containment engineered safety systems for iodine removal in operation, i.e. one spray pump with sodium hydroxide addition, the public exposure would be well below 10 CFR 100 values in the event of the design basis accident.[3]

The safety analyses indicate that the containment leakage rates could be slightly in excess of 0.75% per day before a two-hour thyroid dose of 300R could be received at the side boundary.

The performance of a periodic integrated leakage rate test during plant life provides a current assessment of potential leakage from the containment in case of an accident that would pressurize the interior of the containment. In order to provide a realistic appraisal of the integrity of the containment under accident conditions, this periodic test is to be performed without preliminary leak detection surveys or leak repairs. and containment isolation valves are to be closed in the normal manner. The test pressure of 30 psig or greater for the periodic integrated leakage rate test is sufficiently high to provide an accurate measurement of the leakage rate and it duplicates the pre-operational leakage rate test at 30 psig. The specification provides relationships for relating in a conservative manner, the measured leakage of air at 30 psig or greater to the potential leakage of steam-air mixture at 60 psig and 286°F. The specification also allows for possible deterioration of the leakage rate between tests, by requiring the as measured leak rate to be less than 75% of the allowable leakage rate. The basis for these deterioration allowances are are arbitrary judgements, which are believed to be conservative and which will be confirmed or denied by periodic testing. If indicated to be necessary, the deterioration allowances will be altered based on experience.

The duration of the integrated leak rate test will be 24 hours unless the reduced time duration acceptance criteria are met. One of two sets of acceptance criteria will be used depending on the test evaluation technique used. In 1972, the AEC approved a Bechtel Corporation Topical Report, BN-TOP-1, entitled "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power." This report provides criteria for short duration testing for the Absolute Method using the Total Time technique. This technique was used in the 1970's, but is currently not considered the best technique by the industry and is not being used at Point Beach Nuclear Plant. Point Beach is currently using the Absolute Method, Mass Point technique. The short duration testing criteria for this technique was developed by Quadrex under an EPRI sponsored study (EPRI Research Project No. 1393-5) and is presented in EPRI Report NP-3400, "Criteria for Determining the Duration of Integrated Leakage Rate Tests of Reactor Containments."

The acceptance criteria for short duration testing contained in TS 15.4.4 was taken directly from the EPRI report. The Bechtel and Quadrex short duration testing criteria are very similar in concept. They both contain requirements for stabilization, leakage rate trending, confidence level, sufficient data for statistical convergence, and allowed leakage rate.

The frequency of the periodic integrated leakage rate test is keyed to the refueling schedule for the reactor and shutdown for inservice inspection because these tests can only be performed during refueling shutdowns. The initial core loading was designed for approximately 24 months of power operation, thus the first refueling occurred approximately 30 months after initial

containment. A Residual Heat Removal System leakage of 2 gal/hr will limit off-site exposures due to leakage to insignificant levels relative to those calculated for leakage directly from the containment in the Design Basis Accident. The dose calculated as a result of this leakage is 7.7 mr for a 2 hour exposure at the site boundary.[5]

Periodic visual inspection is the method to be used to determine loss of load-carrying capability because of wire breakage. The pre-stress lift-off test provides a direct measure of the load-carrying capability of the tendon. A deterioration of the corrosion preventive properties of the sheathing filler will be indicated by a change in the physical appearance of the filler. If the surveillance program indicated, by extensive wire breakage or tendon stress relation, that the pre-stressing tendons are not behaving as expected, the situation will be evaluated immediately. The specified acceptance criteria are such as to alert attention to the situation well before the tendon load-carrying capability would deteriorate to a point that failure during a design basis accident might be possible. Thus, the cause of the incipient deterioration could be evaluated and corrective action studied without need to shut down the reactor.

The purpose of the leakage tests of the isolation valves in the containment purge supply and exhaust lines is to identify excessive degradation of the resilient seals for these valves.

<u>References</u>

(1) FSAR Section 5.1.2.3

(2) FSAR Section 5.1.2

(3) FSAR Section 14.3.5

(4) FSAR Section 14.3.4

(5) FSAR Section 6.2.3