LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

3.7 Containment Systems

Applicability

Applies to the operating status of the primary and secondary containment systems.

Objective

To assure the integrity of the primary and secondary containment systems.

Specification

A. Primary Containment

1. Suppression Chamber Water Level and Temperature

The volume and temperature of the water in the suppression chamber shall be maintained within the following limits whenever primary containment is required:

a. Maximum water volume 100,400 ft^3 (corresponding to a downcomer submergence of 3.33 ft. at 1.0 psid)

b. Minimum water volume 98,000 ft^3 (corresponding to a downcomer submergence of 3.0 ft. at 1.0 psid)

c. Maximum water temperature:

4.7 Containment Systems

Applicability

Applies to the primary and secondary containment integrity.

Objective

To verify the integrity of the primary and secondary containment.

Specification

A. Primary Containment

1. The suppression chamber water level and bulk temperature shall be checked once per shift. The interior painted surfaces above the water line of the pressure suppression chamber shall be inspected at each refueling outage.

a. Whenever there is indication of relief valve operation which adds heat to the suppression pool, the bulk pool temperature shall be continually monitored and also observed and logged every 5 minutes until the heat addition is terminated.

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT
(1) During normal power operation - 90°F. (2) During testing which adds heat to the suppression pool, the water temperature shall not exceed 10°F above the normal power operation limit specified in (1) above. In connection with such testing, the pool temperature must be reduced to below the normal power operation limit specified in (1) above within 24 hours. (3) The reactor shall be scrammed from any operating condition if the pool temperature reaches 110°F. Power operation shall not be resumed until the pool temperature is reduced below the normal power operation limit specified in (1) above. (4) During reactor isolation conditions, the reactor pressure vessel shall be depressurized to less than 200 psig at normal cooldown rates if the pool temperature reaches 120°F.	b. Whenever there is indication of relief valve operation with the local temperature of the suppression pool reaching 200°F or more an external visual examination of the suppression chamber shall be conducted before resuming power operation.

A. 1. Primary Containment

The integrity of the primary containment and operation of the emergency core cooling system in combination, limit the off-site doses to values less than those specified in 10 CFR 100 in the event of a break in the primary system piping. Thus, containment integrity is specified whenever the potential for violation of the primary reactor system integrity exists. Concern about such a violation exists whenever the reactor is critical and above atmospheric pressure. An exception is made to this requirement during initial core loading and while the low power test program is being conducted and ready access to the reactor vessel is required. There will be no pressure on the system at this time which will greatly reduce the chances of a pipe break. The reactor may be taken critical during this period; however, restrictive operating procedures will be in effect again to minimize the probability of an accident occurring. Procedures and the Rod Worth Minimizer would limit control worth to less than 1.5% Δk. A drop of a 1.5% Δk rod does not result in any fuel damage. In addition, in the unlikely event that an excursion did occur, the reactor building and standby gas treatment system, which shall be operational during this time, offer a sufficient barrier to keep off-site doses well within 10 CFR 100 guideline values.

2. Suppression Chamber

The pressure suppression pool water provides the heat sink for the reactor primary system energy release following a postulated rupture of the system or for releases through the safety relief valves. The pressure suppression chamber water volume must absorb the associated decay and structural sensible heat released during primary system blowdown from 1035 psig.

Since all of the gases in the drywell are considered purged into the pressure suppression chamber air space during a loss of coolant accident, the pressure resulting from isothermal compression plus the vapor pressure of the liquid must not exceed 62 psig, the suppression chamber design pressure. The design volume of the suppression chamber (water and air) was obtained by considering that the total volume of reactor coolant to be condensed is discharged to the suppression chamber and that the drywell volume is purged to the suppression chamber.

Using the minimum or maximum water volumes given in the specification, containment pressure during the design basis accident is approximately 42 psig which is below the design of 62 psig. Maximum water volume of 100,400 ft^3 results in a downcomer submergence of 3.33 feet and, the minimum volume 98,000 ft^3 results in a submergence of 3.0 feet. The majority of the Bodega tests were run with a submerged length of four feet and with complete condensation. Additional condensation tests were run in the Mark I Full Scale Test Facility (FSTF) at downcomer submergence varying between 1.5 and 4.5 feet and complete condensation of steam resulted. Thus, with respect to downcomer submergence, this specification is adequate.

The maintenance of a drywell-suppression chamber differential pressure of 1.00 psid and a suppression chamber water level corresponding to a downcomer submergence range of 3.0 to 3.33 feet will assure the post-LOCA suppression pool swell hydrodynamic forces are minimized and consistent with loads assumed for structural analysis of the suppression chamber.

The maximum temperature at the end of blowdown tested during the Humboldt Bay[1] and Bodega Bay[2] tests was 170°F and this is conservatively taken to be the limit for complete condensation of the reactor coolant. Tests done in the FSTF showed complete condensation with bulk temperature as high as 185°F with a corresponding surface temperature of 230°F. Regarding condensation of steam released through the SRVs and quenchers, test data has shown complete condensation beyond the 200°F limit of the NRC Acceptance Criteria.

Based on the minimum water volume of 98,000 ft^3 that the Millstone suppression pool contains, the expected bulk pool temperature rise during the reactor blowdown is less than 70°F. With an initial pool temperature of 90°F, considerable margin exists between this postulated pool temperature and the temperature for which complete condensation was demonstrated.

For an initial maximum suppression chamber water temperature of 90°F and assuming the normal complement of pumps (2 LPCI pumps and 2 emergency service water pumps) in each loop, containment pressure is required during a small period of the total accident to maintain adequate net positive suction head (NPSH) for the core spray and LPCI pumps. The availability of the containment pressure required to maintain adequate NPSH during this interval is assured by the containment spray interlocks as described in Amendment 18.

If a loss of coolant accident were to occur when the reactor water temperature is below 330°F, the containment pressure will not exceed the 62 psig design pressure, even if no condensation were to occur. The maximum allowable pool temperature, whenever the reactor is above 212°F, shall be governed by this specification. Thus, specifying water volume temperature requirements applicable for reactor water temperatures above 212°F provides additional margin above that available at 330°F.

In addition to the limits on temperature of the suppression chamber pool water, operating procedures define the action to be taken in the event a relief valve inadvertently opens or sticks open. This action would include: (1) use of all available means to close the valve, (2) initiate suppression pool water cooling heat exchangers, and (3) initiate reactor shutdown.

Robbins, C. H., Tests of a Full Scale 1/48 Segment of the Humboldt Bay Pressure Suppression Containment, GEAP-3596, November 16, 1960.
Bodega Bay Preliminary Hazards Summary Report, Appendix 1, Docket 50-205, December 28, 1962.
NEDE 24539P Mark I Containment Program Full Scale Test Program Final Test Report, April 1979.
NEDO 24575, Mark I Containment Program Plant Unique Load Defnition, Millstone Nuclear Power Station - Unit 1, March 1979.
NRC Acceptance Criteria for Mark I Containment Long Term Program, Rev. 1, February 1980.
NUREG-0661 Mark I Containment Long Term Program, July 1980.