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LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

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CONTAINMENT SYSTEMS

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3/4.6.2 DEPRESSURIZATION, COOLING, AND pH CONTROL SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

The containment spray system and the containment cooling system provide post accident cooling and mixing of the containment atmosphere; however, the containment cooling system is not redundant to the containment spray system. The containment spray system also provides a mechanism for removing iodine from the containment atmosphere and therefore the time requirements for restoring an inoperable spray system to OPERABLE status have been maintained consistent with that assigned other inoperable ESF equipment.

3/4.6.2.2 TRISODIUM PHOSPHATE (TSP)

A hydrated form of granular trisodium phosphate (TSP) is employed as a passive form of pH control for post LOCA containment spray and core cooling water to ensure that iodine, which may be dissolved in the recirculated reactor cooling water following a loss of coolant accident (LOCA), remains in solution. TSP also helps inhibit stress corrosion cracking (SCC) of austenitic stainless steel components in containment during the recirculation phase following an accident. Baskets of TSP are placed on the floor of the containment building to dissolve from released reactor coolant water and containment sprays after a LOCA. Recirculation of the water for core cooling and containment sprays then provides mixing to achieve a uniform solution pH.

Fuel that is damaged during a LOCA will release iodine in several chemical forms to the reactor coolant and to the containment atmosphere. A portion of the iodine in the containment atmosphere is washed to the sump by containment sprays. The emergency core cooling water is borated for reactivity control. This borated water causes the sump solution to be acidic. In a low pH (acidic) solution, dissolved iodine will be converted to a volatile form. The volatile iodine will evolve out of solution into the containment atmosphere, significantly increasing the levels of airborne iodine. The increased levels of airborne iodine in containment contribute to the radiological releases and increase the consequences from the accident due to containment atmosphere leakage.

After a LOCA, the components of the core cooling and containment spray systems will be exposed to high temperature borated water. Prolonged exposure to the core cooling water combined with stresses imposed on the components can cause SCC. The SCC is a function of stress, oxygen and chloride concentrations, pH, temperature, and alloy composition of the components. High temperatures and low pH, which would be present after a LOCA, tend to promote SCC. This can lead to the failure of necessary safety systems or components.

Adjusting the pH of the recirculation solution to levels above 7.0 prevents a significant fraction of the dissolved iodine from converting to a volatile form. The higher pH thus decreases the level of airborne iodine in containment and reduces the radiological consequences from containment atmosphere leakage following a LOCA. Maintaining the solution pH above 7.0 also reduces the occurrence of SCC of austenitic stainless steel components in containment. Reducing SCC reduces the probability of failure of components.

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The SR 4.6.2.2.b requirement to dissolve a representative sample of TSP in a sample of borated water provides assurance that the stored TSP will dissolve in borated water at the postulated post-LOCA temperatures. Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A representative sample of 3.09 ± 0.05 grams of TSP from one of the baskets in containment is submerged in 1.0 ± 0.01 liter of water at a boron concentration of 3130 ± 30 ppm and at a temperature of $120 \pm 5^\circ\text{F}$. The solution is allowed to stand for 4 hours without agitation. The liquid is then decanted from the solution and mixed, the temperature adjusted to $77 \pm 2^\circ\text{F}$ and the pH measured. At this point, the pH must be ≥ 7.0 . The representative sample weight is based on the minimum required TSP weight of 6804 kilograms, which at manufactured density corresponds to the minimum volume of 278 cubic ft, and assumed post LOCA borated water mass in the sump of approximately 4885000 lbm normalized to buffer a 1.0 liter sample. The boron concentration of the test water is representative of the maximum possible boron concentration corresponding to the calculated post LOCA sump volume producing the lowest pH. Agitation of the test solution is prohibited, since an adequate standard for the agitation intensity cannot be specified. The test time of 4 hours is necessary to allow time for the dissolved TSP to naturally diffuse through the sample solution. In the post LOCA containment sump, rapid mixing would occur, significantly decreasing the actual amount of time before the required pH is achieved. This would ensure compliance with the Standard Review Plan requirement of a pH ≥ 7.0 by the onset of recirculation after a LOCA.

3/4.6.2.3 CONTAINMENT COOLING SYSTEM

The OPERABILITY of the containment cooling system ensures that 1) the containment air temperature will be maintained within limits during normal operation, and 2) adequate heat removal capacity is available when operated in conjunction with the containment spray systems during post-LOCA conditions.

The containment spray system is redundant to the containment cooling system in providing post accident cooling and mixing of the containment atmosphere; however, the containment cooling system is not redundant to the containment spray system. As a result of the redundancy of the containment spray system with the containment cooling system, the allowable out-of-service time requirements for the containment cooling system have been appropriately adjusted. However, the allowable out of service time requirements for the containment spray system have been maintained consistent with that assigned other inoperable ESF equipment since the containment spray system also provides a mechanism for removing iodine from the containment atmosphere.

The addition of a biocide to the service water system is performed during containment cooler surveillance to prevent buildup of Asian clams in the coolers when service water is pumped through the cooling coils. This is performed when service water temperature is between 60°F and 80°F since in this water temperature range Asian clams can spawn and produce larva which could pass through service water system strainers.

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3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA. The containment isolation valves have been relocated to plant procedures.

The opening of locked or sealed closed manual and deactivated automatic containment isolation valves on an intermittent basis under administrative control includes the following considerations: (1) stationing an operator, who is in constant communication with control room, at the valve controls, (2) instructing the operator to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside containment.

3/4.6.4 COMBUSTIBLE GAS CONTROL

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with 1) zirconium-water reactions, 2) radiolytic decomposition of water, and 3) corrosion of metal within containment. These hydrogen control systems are consistent with the recommendations of Regulatory Guide 1.7 "Control of Combustible Gas Concentrations in Containment Following a LOCA", March 1971.

The containment cooling units and containment spray pumps provide adequate mixing of the containment atmosphere following a LOCA. This mixing action will prevent localized accumulations of hydrogen from exceeding the flammable limit.