3/4.6.5 ICE CONDENSER

ICE BED

LIMITING CONDITION FOR OPERATION

3.6.5.1 The ice bed shall be OPERABLE with:

a. The stored ice having boron concentration of at least 1800 ppm (the boron being in the form of sodium tetraborate), and a pH of 9.0 to 9.5 at 25°C,

b. Flow channels through the ice condenser,

c. A maximum ice bed temperature of ≤ 27°F,

d. Ice baskets containing at least 1144 lbs of ice (end-of-cycle), and

e. 1944 ice baskets.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the ice bed inoperable, restore the ice bed to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.5.1 The ice condenser shall be determined OPERABLE:

a. At least once per 12 hours by using the ice bed temperature monitoring system to verify that the maximum ice bed temperature is ≤ 27°F.

b. At least once per 18 months by:

1. Chemical analyses which verify that at least 9 representative samples of stored ice have a boron concentration of at least 1800 ppm (the boron being in the form of sodium tetraborate), and a pH of 9.0 to 9.5 at 25°C.

2. Weighing a representative sample of at least 144 ice baskets and verifying that each ice basket contains at least 1144 lbs of ice (end-of-cycle). The representative sample shall include 6 baskets from each of the 24 ice condenser bays and

3/4.6.5 ICE CONDENSER

The requirements associated with each of the components of the ice condenser ensure that the overall system will be available to provide sufficient pressure suppression capability to limit the containment peak pressure transient to less than 12 psig during LOCA conditions.

3/4.6.5.1 ICE BED

The OPERABILITY of the ice bed ensures that the required ice inventory will 1) be distributed evenly through the containment bays, 2) contain sufficient boron to preclude dilution of the containment sump following the LOCA, 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA, 4) contain sufficient water to maintain adequate sump inventory, and 5) result in a post-LOCA sump pH within the allowed range. These conditions are consistent with the assumptions used in the accident analyses.

The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a design basis accident and the additional heat loads that would enter containment during several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators.

Over the course of a fuel cycle, sublimation reduces the weight of ice in the ice condenser. For the ice condenser to be considered OPERABLE, the minimum as-found ice weight of 1144 pounds per ice basket, for those ice baskets selected for weighing per the surveillance requirements, must be present at the end of a fuel cycle. In accordance with the surveillance requirements, if a basket is found to contain less than 1144 pounds of ice, a representative sample of 20 additional baskets from the same bay shall be weighed. The average weight of ice in these 21 baskets (the discrepant basket and the 20 additional baskets) shall be greater than or equal to 1144 pounds at a 95 percent level of confidence. Weighing 20 additional baskets from the same bay in the event a surveillance reveals that a basket contains less that 1144 pounds of ice ensures that no local zone exists that is grossly deficient in ice. Such a zone could experience early melt out during a design basis accident, creating a path for steam to pass through the ice bed without being condensed. An instrument measurement error allowance is included in the required minimum ice basket weight. To account for loss due to sublimation, a conservative average ice bed sublimation of 10% over an eighteen-month period is used. The beginning-of-cycle, or as-left ice basket weight, is adjusted accordingly to assure the LCO limit will be met at the end of each fuel cycle.

The containment subcompartment analysis assumes a uniform 15% blockage of the ice condenser flow channels, utilizing the most restrictive area within the 48 foot height of the ice bed, which are the lattice frame elevations. The analysis conservatively assumes that the restricted area at the lattice frames, further reduced by 15%, exists over the entire 48 foot height of the ice bed. The containment subcompartment analysis lumps the 24 ice condenser bays into six groups for analysis purposes. The 3/8" criterion for frost or ice accumulation in a flow channel provides an indicator of the ice condenser condition. The lattice frame thickness is 3/8" and, therefore, this dimension provides a convenient visual comparison reference during flow passage inspections. More than one restricted flow passage per bay is evidence of abnormal degradation of the ice condenser and would require additional flow passage inspection and engineering assessment to ensure that the 15% blockage assumed in containment subcompartment analysis is met.

3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM

The OPERABILITY of the ice bed temperature monitoring system ensures that the capability is available for monitoring the ice temperature. In the vent the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.

3/4.6.5 ICE CONDENSER

ICE BED

LIMITING CONDITION FOR OPERATION

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a. The stored ice having boron concentration of at least 1800 ppm (the boron being in the form of sodium tetraborate), and a pH of 9.0 to 9.5 at 25°C,

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e. 1944 ice baskets.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the ice bed inoperable, restore the ice bed to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.5.1 The ice condenser shall be determined OPERABLE:

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b. At least once per 18 months by:

1. Chemical analyses which verify that at least 9 representative samples of stored ice have a boron concentration of at least 1800 ppm (the boron being in the form of sodium tetraborate), and a pH of 9.0 to 9.5 at 25°C.

2. Weighing a representative sample of at least 144 ice baskets and verifying that each ice basket contains at least 1144 lbs of ice (end-of-cycle). The representative sample shall include 6 baskets from each of the 24 ice condenser bays and

3/4.6.4 COMBUSTIBLE GAS CONTROL (continued)

Confidence in system OPERABILITY is demonstrated by surveillance testing. Since many igniters are inaccessible at power, surveillance testing in MODE 1 is limited to measurement of igniter current when the DIS is energized by groups. Measured currents are compared with baseline data for the group.

Igniter temperature measurement for all igniters can only be performed during shutdown and is performed every 18 months. This testing energizes all igniters and confirms the ability of each igniter to obtain a surface temperature of at least 1700°F. This temperature is conservatively above the temperature necessary to ignite hydrogen mixtures at concentrations near the lower flammability limit. Test experience indicates that individual igniter failures are generally total failures and do not involve the inability to reach the required temperature when an igniter is drawing normal amperage. This observed failure mode provides reasonable confidence that an igniter failing to reach the required temperature would also be detected by reduced group current measurements during the MODE 1 surveillances. Therefore the 18 month frequency for actual temperature measurements is acceptable.

3/4.6.5 ICE CONDENSER

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3/4.6.5.1 ICE BED

The OPERABILITY of the ice bed ensures that the required ice inventory will 1) be distributed evenly through the containment bays, 2) contain sufficient boron to preclude dilution of the containment sump following the LOCA, 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA, 4) contain sufficient water to maintain adequate sump inventory, and 5) result in a post-LOCA sump pH within the allowed range. These conditions are consistent with the assumptions used in the accident analyses.

The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a design basis accident and the additional heat loads that would enter containment during several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators.

Over the course of a fuel cycle, sublimation reduces the weight of ice in the ice condenser. For the ice condenser to be considered OPERABLE, the minimum as-found ice weight of 1144 pounds per ice basket, for those ice baskets selected for weighing per the surveillance requirements, must be present at the end of a fuel cycle. In accordance with the surveillance requirements, if a basket is found to contain less than 1144 pounds of ice, a representative sample of 20 additional baskets from the same bay shall be weighed. The average weight of ice in these 21 baskets (the discrepant basket and the 20 additional baskets) shall be greater than or equal to 1144 pounds at a 95 percent level of confidence. Weighing 20 additional baskets from the same bay in the event a surveillance reveals that a basket contains less than 1144 pounds of ice ensures that no local zone exists that is grossly deficient in ice. Such a zone could experience early melt out during a design basis accident, creating a path for steam to pass through the ice bed without being condensed. An instrument measurement error allowance is included in the required minimum ice basket weight. To account for loss due to sublimation, a conservative average ice bed sublimation of 10% over an eighteen-month period is used. The beginning-of-cycle, or as-left ice basket weight, is adjusted accordingly to assure the LCO limit will be met at the end of each fuel cycle.

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3/4.6.5.2 ICE BED TEMPERATURE MONITORING SYSTEM

The OPERABILITY of the ice bed temperature monitoring system ensures that the capability is available for monitoring the ice temperature. In the event the monitoring system is inoperable, the ACTION requirements provide assurance that the ice bed heat removal capacity will be retained within the specified time limits.