Tennessee Valley Authority, Post Office Box 2000, Soddy-Daisy, Tennessee 37379

January 22, 2001

TVA-SQN-TS-00-01 10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-327
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) - UNITS 1 AND 2 - TECHNICAL SPECIFICATION (TS) CHANGE NO. 00-01, "ICE CONDENSER, ICE BED FLOW BLOCKAGE"

In accordance with the provisions of 10 CFR 50.4 and 50.90, TVA is submitting a request for an amendment to SQN's Licenses DPR-77 and 79 to change the Units 1 and 2 TSs.

The proposed change would revise TSs and associated Bases for Surveillance Requirement (SR) 4.6.5.1.b to: (1) clarify the application of the SR, (2) relocate inspection methodology to the TS Bases, and (3) change the frequency for determining ice condenser ice bed flow blockage. The proposed change would also revise the TS Bases for TS Limiting Condition For Operation 3.6.5.3, Action b, to add a note that clarifies action entry.

The proposed changes are consistent with changes initiated as part of an industry effort of working with the NRC staff to enhance TSs related to the ice condensers. The Watts Bar Nuclear Plant (WBN) submittal, under TS Change No. 98-014, provided the Ice Condenser Mini Group lead plant submittal

D030

for the ice condenser ice bed flow blockage TS change. WBN TS Change No. 98-014 was approved by the NRC on July 17, 2000. The WBN TS change is consistent with Standard Technical Specification Change Traveler Form (TSTF) No. 336, Revision 1. TSTF No. 336, Revision 1, was approved by NRC on July 28, 2000.

Both the WBN TS and the industry TSTF changes replaced the visual inspection criteria of 0.38-inch ice or frost buildup to 15 percent blockage of ice bed flow channels at a 95 percent confidence level. The current SQN TSs contain the 15 percent ice bed flow channel blockage criteria. The SQN TS SR was previously modified to the 15 percent criteria under SQN TS Change No. 88-13, which was approved by NRC on January 30, 1989. Therefore, this proposed TS change clarifies the scope of application of a 15 percent blockage criteria.

TVA has determined that there are no significant hazards considerations associated with the proposed change and that the change is exempt from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). The SQN Plant Operations Review Committee and the SQN Nuclear Safety Review Board have reviewed this proposed change and determined that operation of SQN Units 1 and 2, in accordance with the proposed change, will not endanger the health and safety of the public. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter to the Tennessee State Department of Public Health.

Enclosure 1 to this letter provides the description and evaluation of the proposed change. This includes TVA's determination that the proposed change does not involve a significant hazards consideration, and is exempt from environmental review. Enclosure 2 contains copies of the appropriate TS pages from Units 1 and 2 that are marked up to show the proposed change. There are no commitments contained in this letter.

The last Unit 1 performance of this SR was completed on March 13, 2000. This performance dictates the scheduler needs for this amendment. The next scheduled performance is March 13, 2001, with the 25 percent extension, the performance may be extended to June 13, 2001. Therefore, TVA requests that this license amendment request be approved by May 1, 2001, before the next required Unit 1 performance of the SR.

TVA requests that the revised TS be made effective within 45 days of NRC approval. If you have any questions about this change, please telephone me at (423) 843-7170 or J. D. Smith at (423) 843-6672.

Sincerely,

Pedro Salas
Licensing and Industry Affairs Manager

Subscribed and sworn to before me
on this 22 day of January

Notary Public

My Commission Expires October 9, 2002

Enclosures
cc: See page 4

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ENCLOSURE 1

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT (SQN)
UNITS 1 AND 2
DOCKET NOS. 327 AND 328

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE 00-01
DESCRIPTION AND EVALUATION OF THE PROPOSED CHANGE

I. DESCRIPTION OF THE PROPOSED CHANGE

The proposed license amendment would revise the SQN Units 1 and 2 TSs by revising Surveillance Requirement (SR) 4.6.5.1.b to: (1) clarify the application of the SR, (2) relocate inspection methodology to the TS Bases, and (3) change the frequency for determining ice condenser ice bed flow blockage. The proposed change would also revise the TS Bases for TS Limiting Condition For Operation (LCO) 3.6.5.3, Action b, to add a note that clarifies Action b entry requirements.

Specifically, TS SR 4.6.5.1.b currently requires a visual inspection of a random sample of at least 54 flow passages with an applied inspection acceptance criteria of 15 percent blockage from frost and ice to the total flow area in each ice condenser bay. The flow area includes flow passages between ice baskets, past lattice frames, through the intermediate and top deck floor grating, and past the lower inlet plenum support structures and turning vanes. The proposed amendment modifies the application of the acceptance criteria to accumulation of ice on structural members comprising flow channels through the ice bed. This changes the SR by removing frost buildup from the criteria and the lower inlet plenum support structures and turning vanes, and removing intermediate and top deck floor grating (upper plenum) from the scope of inspection. The TS Bases for this SR is changed to: (1) include visual inspection methodology, (2) provide the Westinghouse Electric Company definition for frost and why frost is not an impediment to air and or steam flow through the ice condenser, and (3) provide the bases for not including the lower plenum support structures, turning vanes, and upper plenums as part of the inspection scope. Further, the surveillance frequency is changed from at least once per 12 months to at least once per 18 months.

Additionally, a note is added to the Bases of TS 3.6.5.3 to clarify that entry into TS LCO 3.6.5.3, Action b, is not required for personnel standing on or opening intermediate deck or upper deck doors for short durations for the performance of ice condenser related surveillances, minor maintenance, or a routine task such as a system walkdown.

II. REASON FOR THE PROPOSED CHANGE

Industry events related to the ice condenser prompted a review of related TSs by the Ice Condenser Mini Group (ICMG). Through these reviews, differences were identified between each ice condenser plant's interpretation and implementation of the related TSs.

ICMG review of the ice bed flow passage SR determined that the SR does not adequately provide for the full intent of the surveillance. The review resulted in an ICMG agreed upon proposed amendment to the SR, that provides an acceptance criteria of less than or equal to 15 percent blockage of the most restrictive flow passage location (structural members comprising flow channels through the ice bed), consistent with plant analyses.

Because frost, as recognized by Westinghouse, is not an impediment to steam and air flow, and to preclude declarations of inoperability due to frost rather than ice, the Westinghouse definition for frost has been added to the Bases of SR 4.6.5.1, specifically excluding frost as a flow path blockage.

The change to increase the surveillance interval from 12 months to 18 months would permit performance of the surveillance during refueling outages.

The revision to the Bases of TS 3.6.5.3 adds a clarifying note that entry into LCO 3.6.5.3, Action b, is not required solely because personnel are standing on or opening intermediate deck or upper deck doors for short durations for the performance of ice condenser related surveillances, minor maintenance, or a routine task. This eliminates unnecessary declaration of entry into Action b when these activities are performed, but does not preclude its entry if during these activities, doors are found to be open, or otherwise physically restrained or inoperable.

The proposed changes will provide additional assurance that TSs and accident analysis assumptions are maintained, provide consistency between the ice condenser plants, and will facilitate the regulatory oversight process at each ice condenser plant.

III. SAFETY ANALYSIS

The SQN ice condenser consists of at least 2,082,024 pounds of ice stored in baskets within the ice condenser. The primary purpose of the ice condenser is to provide a large heat sink in the event of a release of energy from a loss-of-coolant accident (LOCA) or a high energy line break (HELB) in containment. The ice would absorb energy and limit containment peak pressure and temperature during the accident transient. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of one of the above design basis accidents (DBA).

The ice condenser is an annular compartment enclosing about 300 degrees of the perimeter of the upper containment compartment, but penetrating the operating deck so that a portion extends into the lower containment compartment. The lower portion has a series of hinged doors (lower inlet doors) exposed to the atmosphere of the lower containment compartment, which, for normal plant operation, are designed to remain closed. At the top of the ice condenser is another set of doors (upper deck panels) that are exposed to the upper containment atmosphere, and also remain closed during normal plant operation. A third set of doors (intermediate deck doors), located below the top deck panels, form the floor of a plenum at the upper part of the ice condenser. These doors also remain closed during normal plant operation. The upper plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets that comprise the ice bed within the ice condenser are arranged to promote heat transfer from steam to the ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing the heat energy released to the containment during a LOCA or HELB.

Should a LOCA or HELB occur, the ice condenser inlet doors (lower containment area) open due to the pressure rise in the lower compartment. This allows air and steam to flow from the lower compartment into the ice condenser. The resulting pressure increase within the ice condenser then causes the intermediate deck doors and top deck panels to open (or for a small pressure increase associated with certain small break LOCAs, bypass through curtains), which allows the air and or steam to flow out of the ice condenser into the upper compartment. Steam condensation within the ice condenser limits the pressure and temperature buildup within containment. A divider barrier separates the upper and lower compartments and ensures steam is directed into the ice condenser. The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a LOCA or HELB and the additional heat loads that would enter containment during several hours following initial blowdown.

Other functions of the ice bed and melted ice are to: (1) remove fission product iodine if released by the core, (2) contribute inventory in the form of melted ice to the containment sump for recirculation mode core cooling, and (3) minimize the occurrence of chloride and caustic stress corrosion of systems and or components exposed to emergency core cooling systems and containment spray fluids.

Proper operation of the ice condenser requires the ice to be distributed throughout the ice condenser and for open flow paths to exist around the ice baskets consistent with DBA assumptions. This is especially important during the initial blowdown so that: (1) the steam and water mixture entering the lower compartment do not pass through only part of the ice condenser depleting the ice there while bypassing the ice in other portions of the ice condenser, and (2) to ensure there is sufficient air and steam flow (i.e., no choke flow) through the ice condenser to prevent lower compartment overpressurization, as this could result in structural failure of the subcompartment walls or containment vessel. DBA analysis has shown that overpressurization of the lower compartment will not occur provided the overall blockage does not exceed the 15 percent section blockage assumed in the transient mass distribution (TMD) analysis. This analysis is not a detailed flow channel analysis. Instead, it lumps the ice condenser bays into six sections of 2.75, 3.25, 6.50, 4.50, 3.50, and 3.50 bays.[1] Sensitivity analyses performed in the 1970's showed that up to 15 percent of the flow area can be blocked. According to Westinghouse, an acceptable level of blockage is one that meets the 15 percent criterion based upon the TMD lumping method. That is, there can be individual bays with blockage of greater than 15 percent, or even individual channels blocked, provided the highest calculated percent blockage in any of the TMD lumped sections does not exceed 15 percent.

Currently, the Bases for SQN's SR 3.6.5.1.b identifies the ice condenser flow area to include the lower inlet plenum support structures, turning vanes, ice baskets, lattice frames, and intermediate and top deck floor gratings. As

[1] SQN UFSAR, Figure 6.2.1-6, Plan View at Ice Condenser Elevation - Ice Condenser Compartments.

identified by Westinghouse, the most restrictive flow area location is at a lattice frame elevation. For this reason, the proposed change now defines flow area, as it applies to the 15 percent flow blockage criteria, to be that area between ice baskets and past lattice frames and wall panels. SQN does not have an intermediate floor grating; therefore, the application of visual inspection to the intermediate floor grating has been removed. Because a gross buildup of ice on the lower inlet plenum support structures, turning vanes, and upper deck floor grating would be required before degradation in air and steam flow occurred, these structures have been excluded as part of the flow area for application of the 15 percent blockage criteria. Plant and industry experience have shown that removal of ice from the exempt structures during the refueling outage is sufficient to ensure their operability throughout the operating cycle. Therefore, plant procedures will continue to include a 100 percent inspection and evaluation for any gross ice buildup on the excluded structures, and the removal of identified ice.

The associated TS Bases change relocated the methodology for performing visual inspections of at least 33 percent of the flow channels (54 of 162 per bay). This inspection, of at least 33 percent of flow channels with the use of a statistical methodology such as that described by Westinghouse letter, will provide a 95 percent confidence that flow blockage does not exceed the allowed 15 percent.[2] Also, SQN may perform full visual inspections of all flow channels (162 of 162 per bay), which provides verification that exceeds 95 percent confidence by application of a arithmetic mean, and would not require the application of a population sample statistical methodology. The SQN procedures for inspection of ice condenser flow passages provide a determination of blockage for each inspected flow passage. The current method determines individual flow passage blockage to 0, 25, 50, 75, or 100 percent by visual inspection. The inspection procedures require training of the individuals for performance of the inspection and qualification of the individuals to visual acuity standards that meet or exceed VT-2 requirements.[3] These procedures provide for inspection of the flow areas by

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[2] Letter, Westinghouse, to Tennessee Valley Authority (TVA), dated June 23, 1988, providing surveillance techniques for complying with Sequoyah Nuclear Plant (SQN) TS for inspection of ice basket flow passages (ADAMS # ML003723860); Letter, NRC to TVA, dated January 30, 1989, transmitting Amendment Nos. 98 and 87 to Facility Operating License (FOL) for the SQN Units 1 & 2; and Letter, NRC to TVA, dated July 17, 2000, transmitting Amendment No. 25 to FOL for Watts Bar Nuclear Plant, Unit 1.

[3] American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, IWA 2300, "Qualifications of Nondestructive Examination Personnel," 1989 edition.

looking down from the top of the ice bed and, where view is achievable, up from the bottom of the ice bed. Minimum lighting requirements are provided and include lighting and back lighting with the appropriate intensity to achieve full view of the flow area and minimize glare. Any flow areas that can not be verified to be open are conservatively evaluated as 100 percent blocked. Flow area blockage determination uncertainty, due to inspection methods, is accounted for by procedural controls that establish acceptance criteria less than the TS required limit of 15 percent.

Also, included in the change to the associated TS Bases is the exclusion of frost from flow blockage determinations. The Bases change defines frost as ice which is loosely adherent, and can be easily brushed or knocked off by the hand. Westinghouse concurs that loose ice is judged to either melt or be blown out very quickly during a DBA. Thus, excluding frost from the flow blockage determination does not impact the safety analyses.

Industry improvements in ice bed maintenance has resulted in assurance that the ice condenser can meet and even exceed its design function without performing the ice bed flow blockage surveillance on a 12-month frequency. Management of ice condenser maintenance activities has successfully limited activities, with the potential for significant flow channel degradation, to the refueling outage. By verifying the ice bed is left with less than or equal to 15 percent flow channel blockage at the conclusion of a refueling outage assures that the ice bed will remain in an acceptable condition for the duration of the operating cycle. Therefore, flow channel blockage surveillance should only be required at the conclusion of refueling outages and will effectively demonstrate operability for an allowed 18-month surveillance frequency.

The note added to clarify that entry into TS 3.6.5.3, Action b, is not required when performing surveillances, minor maintenance, and routine tasks (e.g., system engineer walkdowns and special inspections) does not affect the safety analysis. This note only applies to tasks necessary to ensure ice condenser operability, require only a minimal time to perform, and involve a small number of personnel. Action b was provided for intermediate and upper deck doors found to be physically restrained from opening, and for any door condition that threaten ice melt or sublimation, such as a door being found open or incapable of full closure. Performance of required Actions a or b are not necessary when momentarily opening a door to: (1) determine if it is physically restrained, (2) conduct minor maintenance activities such as ice removal, or (3) perform routine tasks such as system walkdowns.

IV. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

TVA has concluded that operation of SQN Units 1 and 2, in accordance with the proposed change to the technical specifications (TSs) does not involve a significant hazards consideration. TVA's conclusion is based on its evaluation, in accordance with 10 CFR 50.91(a)(1), of the three standards set forth in 10 CFR 50.92(c).

A. The proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

The only analyzed accidents of possible consideration in regards to changes potentially affecting the ice condenser are a loss-of-coolant accident (LOCA) and a high energy line break (HELB) inside containment. However, the ice condenser is not postulated as being the initiator of any LOCA or HELB. This is because it is designed to remain functional following a design basis earthquake, and the ice condenser does not interconnect or interact with any systems that interconnect or interact with the reactor coolant or main steam systems.

Neither the TS amendment nor the TS Bases changes can increase the probability of occurrence of any analyzed accident because they are not the result or cause of any physical modification to ice condenser structures, and for the current design of the ice condenser, there is no correlation between any credible failure of it and the initiation of any previously analyzed event.

Regarding the consequences of analyzed accidents, the ice condenser is an engineered safety feature designed, in part, to limit the containment subcompartment and steel containment vessel pressures immediately following the initiation of a LOCA or HELB. Conservative subcompartment pressure analysis shows this criteria will be met if the reduction in the flow area per bay provided for ice condenser air and or steam flow channels is less than or equal to 15 percent, or if the total flow area blocked within each lumped analysis section is less than or equal to the 15 percent as assumed in the safety analysis.

The proposed amendment also revises the flow area verification surveillance frequency from at least once per 12 months to at least once per 18 months such that it will coincide with refueling outages. Management of ice condenser maintenance activities has successfully limited activities, with the potential for significant flow channel degradation, to the refueling outage. Verifying an ice bed is left with less than or equal to 15 percent flow channel blockage at the conclusion of a refueling outage assures the ice bed will remain in an acceptable condition for the duration of the operating cycle. During the operating cycle, a certain amount of ice sublimates and reforms as frost on the colder surfaces in the ice condenser. However, frost does not degrade the flow channel flow area. The surveillance will effectively demonstrate operability for an allowed 18-month surveillance period. Therefore, increasing the surveillance interval does not affect the ice condenser operation or accident response. Limiting ice bed flow channel blockage to less than or equal to 15 percent ensures operation is consistent with the assumptions of the DBA analyses. Thus, the proposed amendment for flow blockage determination provides the necessary assurance that flow channel requirements are met without additional evaluations and thus will not increase the consequences of a LOCA or HELB.

In regard to TS 3.6.5.3 Bases change, clarifying the action entry of Action b to not apply when personnel are standing on or opening doors for a short duration to perform surveillances or minor maintenance activities, such as ice removal, does not increase analyzed accident consequences. These are not new or additional actions compared to those performed previously, the probability of an accident versus the time to perform these actions is small, the number of personnel involved is small, and their duration is generally much less than the four-hour frequency of required Action b (monitor maximum ice condenser temperature). Therefore, these activities do not adversely affect ice bed sublimation, melting, or ice condenser flow channels. However, if during these activities any door is determined to be restrained, not fully closed from a previous activity, or otherwise not operable, then separate entry into Action b is required.

Thus, based on the above, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

B. **<u>The proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.</u>**

Because the TS and Bases changes do not involve any physical changes to the ice condenser, or make any changes in the operational or maintenance aspects of the ice condenser as required by the TSs, there can be no new accidents created from those already identified and evaluated.

C. **<u>The proposed amendment does not involve a significant reduction in a margin of safety.</u>**

Design basis accident analysis have shown that with 85 percent of the total flow area available (uniformly distributed), the ice condenser will perform its intended function. Thus, the safety limit for ice condenser operability is a maximum 15 percent blockage of flow channels. Surveillance Requirement (SR) 4.6.5.1 currently applies the 15 percent flow blockage criteria to the total flow area of each bay which includes flow passages between the ice baskets, past lattice frames, through intermediate and top deck floor grating, or past lower plenum support structures and turning vanes. This application of the criteria does not have direct correlation to the safety limit for blockage of ice condenser flow channels (those areas that comprise the area between ice baskets, and past lattice frames and wall panels). Changing the TS to implement a surveillance program that uses acceptance criteria consistent with the transient mass distribution (TMD) analysis will not reduce the margin of safety.

Additionally, verifying an ice bed is left with less than or equal to 15 percent flow channel blockage at the end of a refueling outage assures the ice bed will remain in an acceptable condition for the duration of the operating cycle. During the operating cycle, a certain amount of ice sublimates and reforms as frost on the colder surfaces in the ice condenser. However, frost has been determined to not degrade the flow channel flow area. Thus, design limits for the continued safe function of containment subcompartment walls and the steel containment vessel are not exceeded due to this change.

The change made to TS 3.6.5.3 Bases does not affect the margin of safety as defined in any TSs as it does not involve design specifications or acceptance criteria. This change only adds a clarifying note that entry into Action b is not required solely because of actions (standing on and opening intermediate/upper deck doors) necessary for the performance of required ice condenser surveillances, maintenance, or routine activities. This does not preclude entry into Action b during performance of these activities should an intermediate deck door or upper deck door otherwise be determined inoperable.

V. ENVIRONMENTAL IMPACT CONSIDERATION

The proposed change does not involve a significant hazards consideration, a significant change in the types of or significant increase in the amounts of any effluents that may be released offsite, or a significant increase in individual or cumulative occupational radiation exposure.

Therefore, the proposed change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), and pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed change is not required.

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH PLANT (SQN)
UNITS 1 AND 2

PROPOSED TECHNICAL SPECIFICATION (TS) CHANGE
MARKED PAGES

I. AFFECTED PAGE LIST

Unit 1

3/4 6-26
B3/4 6-4 (No change on this page - provided for information only)
B3/4 6-5

UNIT 2

3/4 6-27
B3/4 6-4 (No change on this page - provided for information only)
B3/4 6-5

II. MARKED PAGES

See attached.

CONTAINMENT SYSTEMS

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 a boron concentration of at least 1800 ppm boron as sodium tetraborate and a pH of 9.0 to 9.5,

b. Flow channels through the ice condenser,

c. A maximum ice bed temperature of less than or equal 27°F,

d. A total ice weight of at least 2,082,024 pounds at a 95% level of confidence, 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 less than or equal to 27°F.

b. At least once per ~~12~~ 18 months by:

Insert A

~~Verifying, by visual inspection of a representative random sample of at least 54 flow passages (33 percent) per ice condenser bay, that the accumulation of frost or ice on flow passages between ice baskets, past lattice frames, through the intermediate and top deck floor grating, or past the lower inlet plenum support structures and turning vanes is less than or equal to 15-percent blockage of the total flow area in each bay, with a 95-percent level of confidence.~~

~~If the summation of blockage from the sample fails to meet the acceptance criteria, then 100 percent of the passages of that bay shall be inspected. If the 100-percent inspection fails to meet the acceptance criteria, then the flow passages shall be cleaned to meet the acceptance criteria. Each flow passage that is cleaned will be reinspected. Any inaccessible flow passage that is not inspected will be considered blocked.~~

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 or the hydrogen mitigation system, consisting of 68 hydrogen ignitions per unit, is capable of controlling the expected hydrogen generation associated with 1) zirconium-water reactions, 2) radiolytic decomposition of water and 3) corrosion of metals within containment. These hydrogen control systems are designed to mitigate the effects of an accident as described in Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a LOCA", Revision 2 dated November 1978. The hydrogen monitors of Specification 3.6.4.1 are part of the accident monitoring instrumentation in Specification 3.3.3.7 and are designated as Type A, Category 1 in accordance with Regulatory Guide 1.97, Revision 2, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," December 1980.

The hydrogen mixing systems are provided to ensure adequate mixing of the containment atmosphere following a LOCA. This mixing action will prevent localized accumulations of hydrogen from exceeding the flammable limit.

The operability of at least 66 of 68 ignitors in the hydrogen mitigation system will maintain an effective coverage throughout the containment. This system of ignitors will initiate combustion of any significant amount of hydrogen released after a degraded core accident. This system is to ensure burning in a controlled manner as the hydrogen is released instead of allowing it to be ignited at high concentrations by a random ignition source.

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 and 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA. These conditions are consistent with the assumptions used in the accident analyses.

The minimum weight figure of 1071 pounds of ice per basket contains a 15% conservative allowance for ice loss through sublimation which is a factor of 15 higher than assumed for the ice condenser design. The minimum weight figure of 2,082,024 pounds of ice also contains an additional 1% conservative allowance to account for systematic error in weighing instruments. In the event that observed sublimation rates are equal to or lower than design predictions after three years of operation, the minimum ice baskets weight may be adjusted downward. In addition, the number of ice baskets required to be weighed each 9 months may be reduced after 3 years of operation if such a reduction is supported by observed sublimation data. ← Insert B

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.

3/4.6.5.3 ICE CONDENSER DOORS

The OPERABILITY of the ice condenser doors ensures that these doors will open because of the differential pressure between upper and lower containment resulting from the blowdown of reactor coolant during a LOCA and that the blow-down will be diverted through the ice condenser bays for heat removal and thus containment pressure control. The requirement that the doors be maintained closed during normal operation ensures that excessive sublimation of the ice will not occur because of warm air intrusion from the lower containment.

If an ice condenser inlet door is physically restrained from opening, the system function is degraded, and immediate action must be taken to restore the opening capability of the inlet door. Being physically restrained from opening is defined as those conditions in which an inlet door is physically blocked from opening by installation of a blocking device or by an obstruction from temporary or permanently installed equipment or is otherwise inhibited from opening such as may result from ice, frost, debris, or increased inlet door opening torque beyond the valves specified in Surveillance Requirement 4.6.5.3.1. ← Insert C

3/4.6.5.4 INLET DOOR POSITION MONITORING SYSTEM

The OPERABILITY of the inlet door position monitoring system ensures that the capability is available for monitoring the individual inlet door position. 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.

3/4.6.5.5 DIVIDER BARRIER PERSONNEL ACCESS DOORS AND EQUIPMENT HATCHES

The requirements for the divider barrier personnel access doors and equipment hatches being closed and OPERABLE ensure that a minimum bypass steam flow will occur from the lower to the upper containment compartments during a LOCA. This condition ensures a diversion of the steam through the ice condenser bays that is consistent with the LOCA analyses.

3/4.6.5.6 CONTAINMENT AIR RETURN FANS

The OPERABILITY of the containment air return fans ensures that following a LOCA 1) the containment atmosphere is circulated for cooling by the spray system and 2) the accumulation of hydrogen in localized portions of the containment structure is minimized.

CONTAINMENT SYSTEMS

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 a boron concentration of at least 1800 ppm boron as sodium tetraborate and a pH of 9.0 to 9.5,

b. Flow channels through the ice condenser,

c. A maximum ice bed temperature of less than or equal to 27°F,

d. A total ice weight of at least 2,082,024 pounds at a 95% level of confidence, 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 less than or equal to 27°F.

b. At least once per ~~12~~ 18 months by:

Insert A

~~Verifying, by visual inspection of a representative random sample of at least 54 flow passages (33 percent) per ice condenser bay, that the accumulation of frost or ice on flow passages between ice baskets, past lattice frames, through the intermediate and top deck floor grating, or past the lower inlet plenum support structures and turning vanes is less than or equal to 15-percent blockage of the total flow area in each bay, with a 95-percent level of confidence.~~

~~If the summation of blockage from the sample fails to meet the acceptance criteria, then 100 percent of the passages of that bay shall be inspected. If the 100-percent inspection fails to meet the acceptance criteria, then the flow passages shall be cleaned to meet the acceptance criteria. Each flow passage that is cleaned will be reinspected. Any inaccessible flow passage that is not inspected will be considered blocked.~~

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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 or the hydrogen mitigation system, consisting of 68 hydrogen igniters per unit, is capable of controlling the expected hydrogen generation associated with 1) zirconium-water reactions, 2) radiolytic decomposition of water and 3) corrosion of metals within containment. These hydrogen control systems are designed to mitigate the effects of an accident as described in Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a LOCA," Revision 2, dated November 1978. The hydrogen monitors of Specification 3.6.4.1 are part of the accident monitoring instrumentation in Specification 3.3.3.7 and are designated as Type A, Category 1 in accordance with Regulatory Guide 1.97, Revision 2, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," December 1980.

The hydrogen mixing systems are provided to ensure adequate mixing of the containment atmosphere following a LOCA. This mixing action will prevent localized accumulations of hydrogen from exceeding the flammable limit.

The operability of at least 66 of 68 igniters in the hydrogen control distributed ignition system will maintain an effective coverage throughout the containment. This system of ignitors will initiate combustion of any significant amount of hydrogen released after a degraded core accident. This system is to ensure burning in a controlled manner as the hydrogen is released instead of allowing it to be ignited at high concentrations by a random ignition source.

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 and 3) contain sufficient heat removal capability to condense the reactor system volume released during a LOCA. These conditions are consistent with the assumptions used in the accident analyses.

The minimum weight figure of 1071 pounds of ice per basket contains a 15% conservative allowance for ice loss through sublimation which is a factor of 15 higher than assumed for the ice condenser design. The minimum weight figure of 2,082,024 pounds of ice also contains an additional 1% conservative allowance to account for systematic error in weighing instruments. In the event that observed sublimation rates are equal to or lower than design predictions after three years of operation, the minimum ice baskets weight may be adjusted downward. In addition, the number of ice baskets required to be weighed each 9 months may be reduced after 3 years of operation if such a reduction is supported by observed sublimation data. ← **Insert B**

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.

3/4.6.5.3 ICE CONDENSER DOORS

The OPERABILITY of the ice condenser doors ensures that these doors will open because of the differential pressure between upper and lower containment resulting from the blowdown of reactor coolant during a LOCA and that the blow-down will be diverted through the ice condenser bays for heat removal and thus containment pressure control. The requirement that the doors be maintained closed during normal operation ensures that excessive sublimation of the ice will not occur because of warm air intrusion from the lower containment.

If an ice condenser inlet door is physically restrained from opening, the system function is degraded, and immediate action must be taken to restore the opening capability of the inlet door. Being physically restrained from opening is defined as those conditions in which an inlet door is physically blocked from opening by installation of a blocking device or by an obstruction from temporary or permanently installed equipment or is otherwise inhibited from opening such as may result from ice, frost, debris, or increased inlet door opening torque beyond the values specified in Surveillance Requirement 4.6.5.3.1. ← **Insert C**

3/4.6.5.4 INLET DOOR POSITION MONITORING SYSTEM

The OPERABILITY of the inlet door position monitoring system ensures that the capability is available for monitoring the individual inlet door position. 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.

3/4.6.5.5 DIVIDER BARRIER PERSONNEL ACCESS DOORS AND EQUIPMENT HATCHES

The requirements for the divider barrier personnel access doors and equipment hatches being closed and OPERABLE ensure that a minimum bypass steam flow will occur from the lower to the upper containment compartments during a LOCA. This condition ensures a diversion of the steam through the ice condenser bays that is consistent with the LOCA analyses.

3/4.6.5.6 CONTAINMENT AIR RETURN FANS

The OPERABILITY of the containment air return fans ensures that following a LOCA 1) the containment atmosphere is circulated for cooling by the spray system and 2) the accumulation of hydrogen in localized portions of the containment structure is minimized.

INSERT A

Verify, by visual inspection, accumulation of ice on structural members comprising flow channels through the ice bed is ≤ 15 percent blockage of the total flow area for each safety analysis section.

Insert B

The ice baskets contain the ice within the ice condenser. The ice bed is considered to consist of the total volume from the bottom elevation of the ice baskets to the top elevation of the ice baskets. The ice baskets position the ice within the ice bed in an arrangement to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a Design Basis Accident.

This Surveillance Requirement (SR), ice bed flow channel, ensures that the air/steam flow channels through the ice bed have not accumulated ice blockage that exceeds 15 percent of the total flow area through the ice bed region. The allowable 15 percent buildup of ice is based on the analysis of subcompartment response to a design basis Loss of Coolant Accident with partial blockage of the ice bed flow channels. The analysis did not perform a detailed flow area modeling, but rather lumped the ice condenser bays into six sections ranging from 2.75 bays to 6.5 bays. Individual bays are acceptable with greater than 15 percent blockage, as long as 15 percent blockage is not exceeded for the analysis section.

To provide a 95 percent confidence that flow blockage does not exceed the allowed 15 percent, visual inspection must be made for at least 54 (33 percent) of the 162 flow channels per ice condenser bay. The visual inspection of the ice bed flow channels is to inspect the flow area, by looking down from the top of the ice bed, and where view is achievable up from the bottom of the ice bed. Flow channels to be inspected are determined by random sample. As the most restrictive flow passage location is found at a lattice frame elevation, the 15 percent blockage criteria only applies to "flow channels" that comprise the area:

a. between ice baskets, and

b. past lattice frames and wall panels.

Due to a significantly larger flow area in the regions of the upper deck grating and the lower inlet plenum and turning vanes, it would require a gross buildup of ice on these structures to obtain a degradation in air/steam flow. Therefore, these structures are excluded as part of a flow channel for application of the 15 percent blockage criteria. Plant and industry experience have shown that removal of ice from the excluded structures during the refueling outage is sufficient to ensure they remain operable throughout the operating cycle. Thus, removal of any gross ice buildup on the excluded structures is performed following outage maintenance activities.

Operating experience has demonstrated that the ice bed is the region that is the most flow restrictive, because of the normal presence of ice accumulation on lattice frames and wall panels. The flow area through the ice basket support platform is not a more restrictive flow area because it is easily accessible from the lower plenum and is maintained clear of ice accumulation. There is not a mechanistically credible method for ice to accumulate on the ice basket support platform during plant operation. Plant and industry experience have shown that the vertical flow area through the ice basket support platform remains clear of ice accumulation that could produce blockage. Normally only a glaze may develop or exist on the ice basket support platform which is not significant to blockage of flow area. Additionally, outage maintenance practices provide measures to clear the ice basket support platform following maintenance activities of any accumulation of ice that could block flow areas.

Frost buildup or loose ice is not to be considered as flow channel blockage, whereas attached ice is considered blockage of a flow channel. Frost is the solid form of water that is loosely adherent, and can be brushed off with the open hand.

The frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18-month interval, the weight requirements are maintained with no significant degradation between surveillances.

Insert C

Note: entry into Limiting Condition for Operation Action Statement 3.6.5.3.b is not required due to personnel standing on or opening an intermediate deck or upper deck door for short durations to perform required surveillances, minor maintenance such as ice removal, or routine tasks such as system walkdowns.