UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 22, 2001

Mr. J. A. Scalice
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS REGARDING ICE CONDENSER FLOW BLOCKAGE (TAC NOS. MB1028 AND MB1029) (TS 00-01)

Dear Mr. Scalice:

The Commission has issued the enclosed Amendment No. 267 to Facility Operating License No. DPR-77 and Amendment No. 258 to Facility Operating License No. DPR-79 for the Sequoyah Nuclear Plant (SQN), Units 1 and 2, respectively. These amendments are in response to your application dated January 22, 2001, in which Tennessee Valley Authority requested changes to the SQN Technical Specifications (TS). Specifically, the amendments revise TS 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.

A copy of the Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,

Ronald W. Hernan

Ronald W. Hernan, Senior Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

Enclosures:
1. Amendment No. 267 to License No. DPR-77
2. Amendment No. 258 to License No. DPR-79
3. Safety Evaluation

cc w/enclosures: See next page

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Mr. J. A. Scalice
Tennessee Valley Authority

SEQUOYAH NUCLEAR PLANT

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-327

SEQUOYAH NUCLEAR PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 267
License No. DPR-77

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Tennessee Valley Authority (the licensee) dated January 22, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. DPR-77 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 267 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 45 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Richard P. Correia

Richard P. Correia, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: March 22, 2001

ATTACHMENT TO LICENSE AMENDMENT NO. 267

FACILITY OPERATING LICENSE NO. DPR-77

DOCKET NO. 50-327

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
3/4 6-26	3/4 6-26
B 3/4 6-5	B 3/4 6-5
--	B 3/4 6-5a
B 3/4 6-6	B 3/4 6-6

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 18 months by verifying, 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.

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.

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.

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.

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.

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.

3/4.6.5.7 and 3/4.6.5.8 FLOOR AND REFUELING CANAL DRAINS

The OPERABILITY of the ice condenser floor and refueling canal drains ensures that following a LOCA, the water from the melted ice and containment spray system has access for drainage back to the containment lower compartment and subsequently to the sump. This condition ensures the availability of the water for long term cooling of the reactor during the post accident phase.

3/4.6.5.9 DIVIDER BARRIER SEAL

The requirement for the divider barrier seal to be OPERABLE ensures 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 steam through the ice condenser bays that is consistent with the LOCA analyses.

3/4.6.6 VACUUM RELIEF VALVES

The OPERABILITY of three primary containment vacuum relief lines ensures that the containment internal pressure does not become more negative than 0.1 psid. This condition is necessary to prevent exceeding the containment design limit for internal vacuum of 0.5 psid. A vacuum relief line consists of a self-actuating vacuum relief valve, a pneumatically operated isolation valve, associated piping, and instrumentation and controls.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-328

SEQUOYAH NUCLEAR PLANT, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 258
License No. DPR-79

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Tennessee Valley Authority (the licensee) dated January 22, 2001, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. DPR-79 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 258 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented within 45 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Richard P. Correia, Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: March 22, 2001

ATTACHMENT TO LICENSE AMENDMENT NO. 258

FACILITY OPERATING LICENSE NO. DPR-79

DOCKET NO. 50-328

Replace the following pages of the Appendix A Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
3/4 6-27	3/4 6-27
B 3/4 6-5	B 3/4 6-5
--	B 3/4 6-5a
B 3/4 6-6	B 3/4 6-6

CONTAINMENT SYSTEMS

3/4.6.5 ICE CONDENSER

ICE BED

LIMITING CONDITION FOR OPERATION

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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

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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.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 267 TO FACILITY OPERATING LICENSE NO. DPR-77

AND AMENDMENT NO. 258 TO FACILITY OPERATING LICENSE NO. DPR-79

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

1.0 INTRODUCTION

In a letter dated January 22, 2001, the Tennessee Valley Authority (TVA) requested changes to the Technical Specifications (TS) for the operation of Sequoyah Nuclear Plant (SQN), Units 1 and 2. Specifically, the amendments would revise TS and their 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 (LCO) 3.6.5.3, Action b, to add a note that clarifies action entry.

2.0 BACKGROUND

SQN 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 criterion 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 are 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.

Industry events related to the ice condenser prompted a review of related TS 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 TS. 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. These changes were approved by the U.S. Nuclear Regulatory Commission (NRC) as Technical Specification Traveler Form (TSTF) No. 336, Revision 1, on October 31, 2000.

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 because the SQN units are on an 18-month operating cycle.

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 routine tasks. 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 TS 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.

3.0 EVALUATION

3.1 Licensee's evaluation

The SQN ice condenser consists of at least 2,082,024 pounds of borated 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 risk of 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. 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 4.6.5.1.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 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. 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 an 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 as 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. These procedures provide for inspection of the flow areas by 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 cannot 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 have 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 a $\leq$ 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.

3.2 Staff Evaluation

3.2.1 Inspection criteria

As noted above, the purpose of the change is to revise the TS such that it is based on the design basis analysis for the plant. TVA indicates that the Westinghouse analysis has shown that over-pressurization of the lower compartment will not occur provided the overall blockage is less than the 15 percent section blockage assumed in the TMD analysis. The analysis methodology supports that there can be individual bays with blockage of greater than 15 percent, or even individual channels blocked, provided the highest calculated percent blockage in each of the TMD lumped sections is ≤ 15 percent.

The U.S. Nuclear Regulatory Commission (NRC) staff issued an amendment for the Watts Bar Nuclear Plant (WBN) to incorporate the revisions requested by TVA in their January 22, 2001, letter for SQN. WBN is very close to being a replicate plant to SQN. As part of the NRC staff's review of the WBN license amendment application on this issue, the staff sent a Request for Additional information (RAI) to TVA on November 18, 1999. Many of the questions asked in the WBN RAI, and responded to by TVA in a letter to the NRC dated January 31, 2000, are relevant to this review of the SQN amendment application. For example, the staff requested a discussion of the basis for the provision of a 95 percent confidence level. TVA indicated that the statistical methodology is the same as that previously referenced to support an application for an amendment to the SQN units. The statistical methodology is not included in letters related to the SQN ice condenser, but was included in a Westinghouse letter to SQN dated June 23, 1998. The Westinghouse letter provided details on the statistical calculational methodology including a discussion of how the statistical equations have been converted to a set of tables. Flow channel inspection results for each bay may be compared to the tables to determine whether the 15 percent limit is met. The staff has reviewed TVA's response to that question and agrees that the described methodology is acceptable for the stated purpose.

The WBN RAI and response thereto also addressed the need for a margin on the 15 percent blockage limit to account for errors and potential frost hardening. The staff notes that with the application of the statistical methodology described in response to the RAI, the percentage blockage indicated by the mean value of the 54 channel inspection sample size, as shown by the tables in the aforementioned Westinghouse letter, must be less than 15 percent, since the mean value plus the standard error component must be ≤ 15 percent. The staff concluded that, in conjunction with the discussion provided for frost in Section 3.2 below, this concern is resolved.

3.2.2 Inspection techniques

The staff requested additional information from TVA during the Watts Bar review on several aspects of how the amount of flow blockage would be determined during an inspection. TVA's response discussed the process where the flow passages are inspected from above and below, with a light source, with the observed blockage being assigned a value from 0 (a clear channel) to 100 percent blocked in increments of 25 percent. The results are then combined for comparison to the acceptance criterion. TVA also indicated that the procedures involved (a) a trained examiner, (b) high intensity lighting, and (c) visual acuity standards that meet or exceed the VT-2 requirements specified in American Society of Mechanical Engineers, Section IX, IWA 2300, "Qualification of Nondestructive Examination personnel." The staff concluded that, on the basis discussed above, this concern was resolved.

3.2.3 Frost Buildup as Flow Blockage

The current SR 4.6.5.1.b requires that the accumulation of ice or frost would be inspected and compared to the acceptance criterion. The proposed change deletes frost from the SR and adds a definition of frost to the Bases to explain why frost is not an impediment to air/steam flow through the ice condenser. TVA takes the position that frost would be distinguished from ice and that if a distinction could not be made between frost versus ice and loose versus fixed obstructions, then the obstruction would be classified as ice and treated as blockage. In response to the RAI for WBN, TVA described the processes that form ice versus those that form frost and takes the position that management of ice condenser maintenance activities has limited the potential for frost conversion to solid ice to the refueling outage. While the staff agrees in general with TVA's conclusions, the staff does not believe that ice condenser operations exclude, in their entirety, the potential for some frost to ice conversion during an operating cycle. This can be due to localized problems such as ice condenser doors or cooling system problems and to formation on the outer and inner walls. The staff believes, however, that these phenomena can be adequately addressed by appropriate ice condenser maintenance practices. These improved practices are listed in TSTF-336 (see Section 2.0 above) and have been implemented at the SQN plant.

TVA also indicated in the past that permanent blockage from components above the top of the ice bed would not be counted as blockage because the flow area is much larger in this area than in the flow passage region. This response is consistent with the discussion on the definition of the locations in a flow channel provided in Section 3.2.4 below and is acceptable.

3.2.4 Definition of the Locations Included in a Flow Channel Blockage Inspection

The scope for a visual inspection of the flow channels in the Bases for SR 4.6.5.1.b has been changed to include the flow channel area between the ice baskets and past lattice frames and wall panels. This area is the limiting area for flow through the ice bed. This flow area is graphically represented by a sketch in TVA's January 31, 2000, submittal regarding the WBN review. The principal effect of this change is to remove the much larger flow areas in the regions of the upper deck grating and the lower inlet plenum and turning vanes from the flow channel area definition. TVA states that past practice has shown that removal of ice from these larger structures during the refueling outages is sufficient to ensure their operability. Accordingly, TVA indicates that plant procedures will now require a 100 percent inspection and evaluation for any gross ice buildup on the excluded structures, and the removal of identified ice, and has provided a specific licensee commitment to this effect.

This issue has been the subject of previous NRC staff review. In that review, the staff determined that inspection, during an operating cycle, of the larger components such as the lower inlet plenum and associated components, such as the turning vanes, is not necessary to meet the intent of the SR. In that evaluation it was recognized that, "The lower inlet plenum and associated components (such as the turning vanes) represent a relatively large free volume, such that the available flow area is not significantly affected by any localized frost/ice buildup within the volume. Specifically, the available flow area in the lower inlet plenum is typically 10 to 100 times the flow area within the ice basket matrix. Hence, the literal application of the subject SR to the lower inlet plenum region has no significant physical basis."

The staff finds the licensee's proposed changes to the Bases to be consistent with the results of the earlier referenced NRC staff review, and for the reasons stated above, to be acceptable.

3.2.5 TS 3.6.5.3.b Entry Not Required for Routine Activities

Although the principal purpose of the licensee's application was to propose changes for the flow channel inspection, TVA has also proposed a change to the Bases for TS 3.6.5.3.b, Ice Condenser Doors. The change would add a note to the Bases as follows:

> 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.

This Action Statement provides the required actions for intermediate deck and lower inlet doors when conditions challenging door operability, such as a door being found open or incapable of full closure are found. TVA states that such conditions are not applicable for routine activities, such as opening doors to test whether they are physically restrained, conducting minor maintenance activities or performing system walkdowns. TVA characterizes these routine activities as involving a small number of personnel and being of a duration that is much less than the 4-hour frequency of Action b. TVA then concludes that such routine activities do not adversely affect ice bed sublimation, melting, or ice condenser flow paths. Subject to such activities being routine operability maintenance of short duration, involving few personnel and not impacting ice bed operability, as described in TVA's submittal, the staff finds the addition of the above stated note to the Bases for TS 3.6.5.3.b to be acceptable.

3.2.6 Inspection Frequency

TVA proposed changing the surveillance frequency from 12 months to 18 months to coincide with the operating cycle length. The intent is to perform the ice blockage inspection following outage maintenance as an "as-left" surveillance. As discussed in Section 2.0 of this evaluation, the NRC staff approved TSTF-336, Rev.1, on October 31, 2000. This TSTF relaxed the frequency from 9 months to 18 months for this inspection, which is specified by Surveillance Requirement 3.6.15.4 in NUREG-1431, Rev. 1, "Standard Technical Specifications -

Westinghouse Plants," commonly referred to as the STS. The staff had based its approval of the TSTF on improvements in ice condenser ice blockage inspection results that industry had attributed to improved ice condenser maintenance techniques. According to the ICMG, these maintenance improvements provide adequate assurance that the ice condenser can meet and even exceed its design function by performing the ice blockage inspection at intervals longer than 9 months (or 12 months in the case of SQN). Specifically, as stated in the TSTF, industry has made or plans to make eight improvements in ice condenser maintenance practices that have been or will be made to better assure ice condenser operability. These improvements include (1) improved control of doors during maintenance to minimize heat and humidity increases, (2) increased attention to maintenance on ice condenser cooling systems, (3) improved training and procedures for emptying and refilling ice baskets, (4) improved training and procedures for the ice blockage inspection surveillance, and (5) increasing the minimum sample size requirement for the flow passage surveillance. The basis for relaxing the ice blockage inspection surveillance frequency in the STS applies to SQN because SQN has implemented these improved ice condenser maintenance and surveillance practices. During a conference call on February 21, 2001, between the NRC (R. Hernan) and TVA (J. Smith), TVA confirmed that, in fact, SQN has implemented the improvements listed in TSTF-336. Therefore, the NRC staff concludes that relaxing this surveillance interval at SQN is acceptable.

3.3 Staff Conclusion

As indicated in the individual discussions in 3.2 above, the staff has found that the proposed changes with respect to ice condenser operation and surveillance in the SQN TS are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration (66 FR 9388), and there has been no public comment on such finding. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Ronald W. Hernan, NRR

Date: March 22, 2001