Exelon Generation

James A. FitzPatrick Nuclear Power Plant

Technical Evaluation Input for License Amendment Request to Remove Requirements for Deicing Heaters from Technical Specification 3.7.2

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1.0 PURPOSE AND SCOPE

The purpose of this report is to:

(1) Determine whether the James A. FitzPatrick Nuclear Power Plant (JAF) deicing heaters satisfy Title 10 of the Code of Federal Regulations (10 CFR) Paragraph 50.36(c)(2)(ii) Criterion 3 (Ref. 1);
(2) Prepare Technical Evaluation input for a License Amendment Request (LAR) to remove the requirements for deicing heaters from JAF Technical Specification (TS) 3.7.2, if the deicing heaters do not satisfy Criterion 3; and
(3) Review U.S. Nuclear Regulatory Commission (NRC) and U.S. nuclear industry experience to identify precedent LARs or similar licensing actions.

2.0 DESIGN INPUT

The information provided in the JAF TS, TS Bases, and updated Final Safety Analysis Report (FSAR) (Refs. 2, 3, and 4) are used to provide background information related to the emergency service water (ESW) and residual heat removal service water (RHRSW) systems and the ultimate heat sink.

Detailed information related to the design of the intake structure, the associated intake structure bar-racks, historical frazil ice concerns, and the engineering change (EC 62127) to resolve frazil ice concerns (Refs. 5, 6, and 7) are used for the evaluations to address scope items 1 and 2, identified in Section 1.0 of this report.

3.0 ASSUMPTIONS

None.

4.0 METHODOLOGY

This report is prepared in accordance with Sargent & Lundy (S&L) Standard Operating Procedure SOP-0405, “Engineering Evaluations and Reports,” which is based on ASQ/ANSI/ISO 9001:2015 (ISO-9001:2015), “Quality management systems – Requirements.” The Technical Evaluation input for the proposed LAR is written using the guidance of Exelon Generation Procedure LS-AA-101-1000, Revision 13, “License Amendment and Technical Specifications Change Request Process – Training and Reference Material,” and Nuclear Energy Institute (NEI) document NEI 06-02, Revision 2, “License Amendment Request (LAR) Guidelines.”

5.0 RESULTS

Scope item 1 is addressed by the evaluation provided in Section 5.1. Scope item 2 is addressed by Appendix 1 and Attachments 1 and 2 to this report. Scope item 3 is addressed by Section 5.2 of this report.

5.1 Determine whether the deicing heaters satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii)

Paragraph 50.36(c)(2)(ii) of Title 10 of the Code of Federal Regulations (10 CFR) requires that a technical specification (TS) limiting condition for operation (LCO) be established for each item meeting one or more of four specified criteria [Ref. 1]. Criterion 3 of 10 CFR 50.36(c)(2)(ii) states: "A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier."

The emergency service water (ESW) and residual heat removal service water (RHRSW) systems are designed to provide cooling water for the removal of heat from equipment served by those systems following a design basis accident (DBA) or transient. The ability of the ESW and RHRSW systems to provide adequate cooling for this equipment is an implicit assumption for the safety analyses presented in updated Final Safety Analysis Report (FSAR) Chapters 5 and 14.

As stated in TS Bases B 3.7.2 [Ref. 2], the ESW system, together with the ultimate heat sink (UHS), satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). TS LCO 3.7.2, which ensures the functions of the ESW and UHS credited in the safety analyses will be accomplished, requires operability of both divisions of the required deicing heaters when the UHS temperature is ≤ 37ºF [Ref. 3]. TS surveillance requirements SR 3.7.2.3, SR 3.7.2.5, and SR 3.7.2.6 require periodic verification that the required deicing heater performance parameters are within limits for each division of deicing heaters when the UHS temperature is ≤ 37ºF.

The deicing heaters were installed in the intake bars as part of the original plant design to inhibit the formation of frazil ice on the steel bars, a condition which can occur under certain meteorological and plant operating conditions [Ref. 4]. A buildup of frazil ice on the bars could cause a significant reduction in the flow through the intake structure, which could challenge the ability of the ESW and RHRSW pumps to perform their safety functions. Since continued flow through the intake is necessary for the ESW and RHRSW systems to perform their accident mitigation functions, the deicing heaters were a component that was part of the primary success path and which functions to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier

In January 2016, the buildup of frazil ice on the intake bars resulted in a lowering of screenwell water level such that a manual trip of the reactor was required [Ref. 5]. Following that event, operating procedures were revised to ensure the potential for frazil ice formation is more closely monitored and that the necessary actions (e.g., "tempering", where a portion of the circulating water discharge is recirculated back to the entrance to the trash racks to prevent the buildup of ice on the trash racks and traveling screens, downstream of the intake bars) are initiated when appropriate. In addition, an engineering study of the intake system and the hazard posed by icing of the intake bars was undertaken [Ref. 6]. The study concluded that the potential for large debris entering the intake structure and causing damage or blockage was not considered credible and that there was no technical reason to justify the continued use of bars at the intake – particularly in light of their contribution to the intermittent but costly problem of frazil ice.

On the basis of the results of the engineering study and the improved procedural guidance, two of the original eight bar racks were removed under an engineering change (EC 621217) [Ref. 7]. With the removal of the two bar racks, an adequate intake structure suction area, free of frazil ice, is available at all times to support operation of the ESW and RHRSW pumps. Since the deicing heaters are not needed to ensure there is sufficient flow through the intake for the ESW and RHRSW systems to perform their accident mitigation functions, the deicing heaters do not satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

5.2 Review of NRC and Industry Experience

A NRC Agencywide Documents Access and Management System (ADAMS) search was conducted. Only Nine Mile Point Unit 2 was identified as having technical specification requirements for deicing heaters. Ginna has deicing heaters, but there are no technical specification requirements for them. No precedent was found for removal of a similar technical specification at another facility.

6.0 CONCLUSIONS

The requirements deicing heaters do not satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii) and do not need to remain in JAF TS 3.7.2. Appendix 1 to this report proposes input to be used for the Technical Evaluation section of a LAR to remove the requirements for deicing heaters from TS 3.7.2. Attachments 1 and 2 provide example markups for TS 3.7.2 and its associated bases.

7.0 REFERENCES

1. 10 CFR 50.36, “Technical specifications”
2. JAF TS Bases B 3.7.2
3. JAF TS 3.7.2
4. JAF Updated FSAR Section 12.3.7
5. Root Cause Evaluation for CR-JAF-2016-00243
6. WorleyParsons Report FITZ-1-LI-308008-00186-ALL-0001-R0
7. EC 621217, “Removal of Existing Intake Structure Bar-Racks”

Appendix 1

James A. FitzPatrick Nuclear Power Plant
Renewed Facility Operating License No. DPR-59

Technical Evaluation Input for License Amendment Request to Remove Requirements for Deicing Heaters from Technical Specification 3.7.2

Description of Intake Path

The James A. FitzPatrick Nuclear Power Plant (JAF) draws cooling water from an intake structure located on the bottom of Lake Ontario — the ultimate heat sink (UHS) — approximately 900 feet from the shore line. The intake is a roofed structure which draws water in through side openings that are protected with bar racks (two of which were removed in 2017 to address an ice buildup concern, as discussed below) to block the entrance of large debris. This results in water being taken in at lower levels and prevents the formation of vortices at the surface, thus minimizing the possibility of floating ice being drawn down from the surface. The intake bar racks are provided with deicing heaters to inhibit the formation of frazil ice, which might otherwise accumulate on the bar racks and restrict the intake flow. A fish deterrence system is installed on top of the intake structure to prevent the impingement of alewives.

Water is drawn through the intake and intake tunnel into the screenwell building. At the end of the intake tunnel in the screenwell building, there are trash racks (designed to stop large pieces of floating debris) and traveling screens (designed to prevent small pieces of debris and fish from entering the plant systems). After passing through the trash racks and traveling screens, the water is supplied to the circulating water pumps, emergency service water (ESW) pumps, residual heat removal service water (RHRSW) pumps, normal service water (NSW) pumps, the fire protection system, and the makeup demineralizer system.
[*Note to LAR preparer: acronyms may not need to be redefined if defined in previous sections of the LAR*]

The screenwell is configured to allow for “tempering”, where a portion of the circulating water discharge is recirculated back to the entrance to the trash racks to prevent the buildup of ice or to improve condenser performance. Stray frazil ice which is drawn past the intake to the screenwell will then be melted by the tempering water. The screenwell is also configured to allow the flow of circulating water to be reversed in the intake and discharge tunnels to provide a source of suction water for the ESW and RHRSW pumps in the event that the intake pathway becomes blocked by large masses of ice.

The intake structure, bar racks, and deicing heaters are described in section 12.3.7 of the Final Safety Analysis Report (FSAR).

Frazil Ice Problems and Removal of Two Bar Racks

The formation of frazil ice on steel bar racks at intake structure openings is common in northern climates. This kind of ice is formed when meteorological conditions are such that the water is supercooled below its freezing point due to radiational cooling. Under these conditions, frazil ice can form on intake bar racks, or spongy masses of this ice, formed in other parts of the lake and carried past an intake by wind-driven currents, can adhere to the bar racks. A buildup of frazil ice on intake bars can occur suddenly and can cause a significant reduction in the flow through an intake structure.

During power operation at JAF under cold weather conditions, the flow of water into the intake (approximately 435,000 gpm) may draw in frazil ice. During plant shutdown conditions when the circulating water pumps are not operating, the flow velocity of water into the intake structure is so low that significant frazil ice is not drawn into the intake. If a rapid buildup of frazil ice on the intake bars were to begin while the circulating water pumps are in operation, the blockage of the intake could potentially challenge the ability of the ESW and RHRSW pumps to perform their safety functions if circulating water pumps were not secured and a manual SCRAM were not inserted in a timely fashion, as required by existing procedures.

Frazil ice will not form on, or adhere to, bar racks which are at a temperature slightly above the freezing point of water. To inhibit the formation of frazil ice, the original plant design included the installation of heating elements in each of the 88 individual bars — which were grouped in eight bar racks, with a one-foot spacing between individual bars — at the intake. Operability of two divisions of the required deicing heaters is required by JAF technical specification (TS) 3.7.2 when the Ultimate Heat Sink (UHS) temperature is ≤ 37ºF. The deicing heater capacity required for compliance with TS 3.7.2 is defined in TS Bases B 3.7.2 as "at least 18 out of the 44 deicing heaters (each heater producing 1670 ± 10% watts) in each electrical division."

The capacity of the heaters is such as to keep the temperature of the bars at 33°F during periods when no supercooling occurs or above freezing when up to 1°F supercooling occurs. This is an adequate thermal margin to prevent frazil ice, grease ice, or slush build-up on the bars most of the time.

However, ice buildup can occur on the bars because, under extreme meteorological conditions, the amount of supercooling may exceed the thermal margin available. As frazil ice begins to accumulate on the bars under these conditions, the one-foot spacing between the individual bars is reduced, thereby restricting flow through the intake. There have been five events over the years of plant operation where the buildup of frazil ice on the intake bar racks restricted flow through the intake structure to the point that it caused a plant transient. Two of these events resulted in a lowering of screenwell water level such that a manual trip of the reactor was required. Operator action to downpower the reactor was successful in averting a trip during the other three events.

Following the most recent event (on January 23, 2016), operating procedures were revised to ensure that the potential for frazil ice formation is more closely monitored and that the necessary actions (e.g., tempering) are initiated when appropriate. The recirculation of condenser discharge water through tempering not only maintains the water temperature in the screenwell forebay at a level to eliminate ice in that area but also reduces the flow rate and velocity of the water flowing through the intake, thereby slowing the deposition of frazil ice on plant structures.

In addition, an engineering study of the intake system and the hazard posed by icing of the intake bars was undertaken. The study noted that Lake Ontario in the vicinity of the intake is largely free of material that would likely be drawn into the intake structure and that, over the long plant operating life, accumulation of large debris on the intake bars has not been reported. At the intake velocities experienced during normal operation, debris floating above the intake structure such as ice sheets or driftwood is not likely to be pulled down; similarly, heavy debris on the bottom of the lake is not likely to be sucked into the intake ports. The only debris threatening to enter the intake structure would be neutrally buoyant debris suspended in the water at the elevation of the intake ports such as grass or algae from the lake bottom, which the bar rack spacing could not prevent from passing through the intake opening. Debris smaller than the intake openings has always been able to enter the tunnel and is removed by the trash racks and traveling screens. Even if large debris were drawn into the intake structure, the trash racks and traveling screens would protect the pumps from damage from debris that enters the screenwell. The engineering report concluded that the potential for large debris entering the intake structure and causing damage or blockage was not considered credible and that there was no technical reason to justify the continued use of bars at the intake – particularly in light of their contribution to the intermittent but costly problem of frazil ice.

On the basis of the results of the engineering study, two of the original eight bar racks (including the deicing heaters for the bars in those bar racks) were removed under an engineering change (EC 621217). Each 11' x 11' bar rack is configured with 2" x 3" intake bars spaced at one-foot centers. With the removal of the two 11' x 11' bar racks, the restriction in the intake path at those locations increases from the 10-inch wide gap between adjacent bars in a bar rack to an 11-foot wide spacing at each of the former bar rack locations. Therefore, an adequate intake structure suction area, free of frazil ice, is available at all times to support operation of the ESW and RHRSW pumps. With the improved procedural guidance, there is no danger that ice, including frazil ice, will accumulate in the screenwell such that the ESW or RHRSW pumps are challenged.

The remaining six bar racks and their associated deicing heaters remain in place. The remaining deicing heaters will continue to be maintained and, as at present, will continue to be automatically energized when intake temperature is ≤ 37°F.

Since the deicing heaters are no longer needed to ensure there is sufficient flow through the intake for the ESW and RHRSW systems to perform their accident mitigation functions as credited in the safety analyses, there is no need to have a TS limiting condition for operation (LCO) or surveillance requirements for the deicing heaters in the JAF technical specifications. Therefore, the proposed change deletes the existing requirements for the deicing heaters from the technical specifications.

Current TS 3.7.2 and TS 3.7.2 Bases

[*Note to LAR preparer: some plants put this information in Section 1 or 2 of the LAR.*]

The ESW and RHRSW systems are designed to provide cooling water for the removal of heat from equipment served by those systems following a design basis accident (DBA) or transient. The ability of the ESW and RHRSW systems to provide adequate cooling is an implicit assumption for the safety analyses presented in FSAR Chapters 5 and 14. The ESW system, together with the UHS, satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

TS 3.7.2 ensures the minimum heat removal capability assumed in the safety analyses for the system to which the ESW supplies cooling water will be provided. TS LCO 3.7.2 Condition B requires operability of both divisions of the required deicing heaters in Modes 1, 2, and 3 when the UHS temperature is ≤ 37ºF. In Modes 4 and 5, the operability requirements of the ESW system and UHS are determined by the systems they support and, therefore, the requirements are not the same for all facets of operation in Modes 4 and 5.

TS surveillance requirement SR 3.7.2.3 requires periodic verification that the required deicing heater feeder current is within limits for each division of deicing heaters when the UHS temperature is ≤ 37ºF. TS surveillance requirement SR 3.7.2.5 requires periodic verification that the required deicing heater power is within limits for each division of deicing heaters when the UHS temperature is ≤ 37ºF. These surveillances help ensure that adequate heat is being provided at the bar racks to help ensure that frazil ice does not adhere to them. TS surveillance requirement SR 3.7.2.6 requires periodic verification that the required deicing heater resistance to ground is within limits for each division of deicing heaters when the UHS temperature is ≤ 37ºF. This surveillance is performed to monitor long-term degradation of the cable and heater insulations.

Description of Proposed Changes to TS and TS Bases

[*Similar to previous comment – this may be located in the detailed description section of the LAR.*]

Changes are proposed to the following parts of TS LCO 3.7.2.

1. Existing Condition B and proposed changes

Condition B:	One division of required deicing heaters inoperable. <u>AND</u> UHS temperature ≤ 37ºF.
Required Action B.1:	Restore the division of deicing heaters to OPERABLE status.
Completion Time:	7 days

   It is proposed that the above condition, required action, and completion time be deleted.

2. Existing Condition C and proposed changes

Condition C:	Required Action and associated Completion Time not met. OR Both ESW subsystems inoperable for reasons other than Condition A. OR UHS inoperable for reasons other than Condition B.
Required Action C.1:	Be in MODE 3.
Completion Time:	12 hours
Required Action C.2:	Be in MODE 4.
Completion Time:	36 hours

   It is proposed that: (1) the above condition and required actions be renumbered to Condition B and Required Actions B.1 and B.2, respectively; and (2) the phrase “for reasons other than Condition B” be deleted from the Condition statement.

[*May want to refer to attachments – e.g., “See Attachments 2 and 3 for an illustration of the TS markup and the proposed clean TS page.”*]

Changes are proposed to the following TS surveillance requirements.

1. Changes to deicing heater surveillance requirements

   SR 3.7.2.3: Verify the required deicing heater feeder current is within limits for each division of deicing heaters. (Note: Not required to be met if UHS temperature is > 37°F.)
   Frequency: In accordance with the Surveillance Frequency Control Program.

   SR 3.7.2.5: Verify the required deicing heater power is within limits for each division of deicing heaters. (Note: Not required to be met if UHS temperature is > 37°F.)
   Frequency: In accordance with the Surveillance Frequency Control Program.

   SR 3.7.2.6: Verify the required deicing heater resistance to ground is within limits for each division of deicing heaters. (Note: Not required to be met if UHS temperature is > 37°F.)
   Frequency: In accordance with the Surveillance Frequency Control Program.

   It is proposed that these three surveillance requirements be deleted.

2. Changes to other TS 3.7.2 surveillance requirements

   It is proposed that surveillance requirement SR 3.7.2.4 be renumbered to SR 3.7.2.3 and that surveillance requirement SR 3.7.2.7 be renumbered to SR 3.7.2.4.

Changes are proposed to TS Bases B 3.7.2.

1. In the "Background" section, the last paragraph will be deleted.

2. In the "LCO" section, the last two sentences of the third paragraph (i.e., "With UHS temperature ≤ 37ºF, conditions … whenever UHS temperature is ≤37ºF.") will be deleted.

3. In the "Actions" section, Action B.1 will be deleted. Actions C.1 and C.2 will be renumbered to B.1 and B.2.

4. In the "Surveillance Requirements" section, surveillance requirements SR 3.7.2.3, SR 3.7.2.5, and SR 3.7.2.6 will be deleted. Surveillance requirement SR 3.7.2.4 will be renumbered to SR 3.7.2.3, and surveillance requirement SR 3.7.2.7 will be renumbered to SR 3.7.2.4.

[*May want to refer to an attachment – e.g., "See Attachment 4 for an illustration of the TS Bases markups."*]

Attachment 1

James A. FitzPatrick Nuclear Power Plant
Renewed Facility Operating License No. DPR-59

Markup of Technical Specifications Pages

TS Pages
3.7.2-1
3.7.2-2
3.7.2-3
3.7.2-4

3.7 PLANT SYSTEMS

3.7.2 Emergency Service Water (ESW) System and Ultimate Heat Sink (UHS)

LCO 3.7.2 Two ESW subsystems and UHS shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ESW subsystem inoperable.	------------NOTE------------ Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," for emergency diesel generator subsystem made inoperable by ESW. --------------------------- A.1 Restore the ESW subsystem to OPERABLE status.	 7 days
~~B. One division of required deicing heaters inoperable.~~ ~~AND~~ ~~UHS temperature ≤ 37°F.~~	~~B.1 Restore the division of deicing heaters to OPERABLE status.~~	~~7 days~~

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. ~~C.~~ Required Action and associated Completion Time not met. OR Both ESW subsystems inoperable for reasons other than Condition A. OR UHS inoperable ~~for reasons other than Condition B.~~	~~C.1~~ B.1 Be in MODE 3. AND ~~C.2~~ B.2 Be in MODE 4.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.2.1	Verify the water level in the ESW pump screenwell is ≥ 236.5 ft mean sea level.	In accordance with the Surveillance Frequency Control Program
SR 3.7.2.2	Verify the average water temperature of UHS is ≤ 85°F.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.7.2.3~~	~~NOTE~~ ~~Not required to be met if UHS temperature is > 37°F.~~ ~~Verify the required deicing heater feeder current is within limits for each division of deicing heaters.~~	~~In accordance with the Surveillance Frequency Control Program~~
~~SR 3.7.2.4~~ SR 3.7.2.3	NOTE Isolation of flow to individual components does not necessarily render ESW System inoperable. Verify each ESW subsystem manual, power operated, and automatic valve in the flow paths servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program
~~SR 3.7.2.5~~	~~NOTE~~ ~~Not required to be met if UHS temperature is > 37°F.~~ ~~Verify the required deicing heater power is within limits for each division of deicing heaters.~~	~~In accordance with the Surveillance Frequency Control Program~~

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.7.2.6~~	~~-----NOTE-----~~ ~~Not required to be met if UHS temperature is > 37°F.~~ ~~Verify the required deicing heater resistance to ground is within limits for each division of deicing heaters.~~	~~In accordance with the Surveillance Frequency Control Program~~
~~SR 3.7.2.7~~ SR 3.7.2.4	Verify each ESW subsystem actuates on an actual or simulated initiation signal.	In accordance with the Surveillance Frequency Control Program

Attachment 2

James A. FitzPatrick Nuclear Power Plant
Renewed Facility Operating License No. DPR-59

Markup of Technical Specifications Bases Pages
(For Information Only)

TS Bases Pages
B 3.7.2-2
B 3.7.2-3
B 3.7.2-4
B 3.7.2-5
B 3.7.2-6
B 3.7.2-7

B 3.7 PLANT SYSTEMS

B 3.7.2 Emergency Service Water (ESW) System and Ultimate Heat Sink (UHS)

BASES

BACKGROUND

The ESW System is designed to provide cooling water for the removal of heat from equipment, such as the emergency diesel generators (EDGs), electric bay coolers, crescent area coolers, cable tunnel/switchgear room coolers and control room and relay room air handling units, required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. Upon receipt of a loss of offsite power or loss of coolant accident (LOCA) signal, the EDGs will start which in turn starts the associated ESW pump. Each ESW pump will automatically pump to the associated EDG cooler. The remaining ESW loads will be automatically cooled when the associated ESW supply header isolation valve opens and the associated ESW minimum flow valve closes. This occurs when the ESW lockout matrix logic actuates upon low reactor building closed loop cooling water pump discharge pressure. This logic is discussed in LCO 3.3.7.3, "Emergency Service Water (ESW) System Instrumentation". In addition, the ESW pumps will automatically start in response to the ESW lockout matrix logic. However, this function is not required for safe reactor shutdown since the ESW pumps will start when any associated EDG starts.

The ESW System consists of the UHS and two independent and redundant subsystems. Each of the two ESW subsystems is made up of a header, one 3700 gpm pump, a suction source, valves, piping and associated instrumentation. The two subsystems are separated from each other so failure of one subsystem will not affect the OPERABILITY of the other system. The ESW System is described in UFSAR, Section 9.7.1 (Ref. 1).

Cooling water flows from Lake Ontario (UHS) through the intake tunnel to the screenwell where the water is pumped by the ESW pumps to components through the two main headers. After removing heat from the components, the water is discharged to the discharge tunnel where it returns to Lake Ontario.

The lake intake structure is a reinforced concrete structure sitting on the lake bottom at a distance of approximately 900 ft from the shoreline in approximately 25 ft of water. The top surface of the intake structure is at the 233 ft elevation (above sea level), which is approximately 10 ft below the historically lowest monthly mean lake level. The intake is a roofed structure which draws water in through

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BASES

BACKGROUND (continued)

side openings that are protected with bar racks spaced at 1 ft centers to block the entrance of large debris. This results in water being taken in at lower levels and prevents the formation of vortices at the surface, thus minimizing the possibility of floating ice being drawn down from the surface. The side intake area of approximately 8 ft by 70 ft, less bar rack area, provides a net clear area of 552 ft^2. During normal operation, with a maximum nominal operating flow of 388,600 gpm from three circulating water pumps and two normal service water pumps, the average intake velocity is approximately 1.6 ft per second across the intake bar racks. However, during safe shutdown conditions with only two Residual Heat Removal Service Water (RHRSW) pumps and one ESW pump in operation, the maximum nominal flow is reduced to 10,000 gpm, corresponding to an average intake velocity of 0.04 ft per second.

~~The formation of frazil ice on the steel bar racks at the intake structure openings is common in northern climates. This kind of ice is formed when meteorological conditions are such that the water is supercooled below its freezing point due to radiational cooling. Under these conditions, frazil ice can form on intake bar racks or spongy masses of this ice, formed in other parts of the lake and carried past an intake by wind driven currents, can adhere to the bar racks. Sufficient transport velocity exists to move buoyant frazil ice from the lake surface to the intake structure during normal operation, but not under safe shutdown conditions. If ice formation does occur on the bar racks during normal operation, sufficient local erosion velocities will develop to limit total ice accumulation such that the remaining net clear intake area would be sufficient to meet required safe shutdown flows. In an effort to suppress the formation of frazil ice on the bar racks, each of the 88 rack bars is heated by a deicing heater. Each deicing heater is rated at 1670 ± 10% watts and is normally energized. Forty four heaters are powered by one division while the remaining 44 heaters are powered by the other division. The deicing heaters are not adequately sized to prevent frazil ice formation under extreme supercooling conditions, although they will minimize frazil ice formation most of the time.~~

APPLICABLE SAFETY ANALYSES

Since Lake Ontario is the UHS, sufficient water inventory is available for all ESW System post LOCA cooling requirements for a 30 day period. The OPERABILITY of the ESW System is assumed in evaluations of the equipment required for safe reactor shutdown

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

presented in the UFSAR, Chapters 5 and 14 (Refs. 2 and 3, respectively). These analyses include the evaluation of the long term primary containment response after a design basis LOCA.

The ability of the ESW System to provide adequate cooling to the identified safety equipment is an implicit assumption for the safety analyses evaluated in References 2 and 3. The ability to provide onsite emergency AC power is dependent on the ability of the ESW System to cool the EDGs. The long term cooling capability of RHR and core spray pumps is dependent on the capability of the ESW System to provide cooling to the EDGs as well as the crescent area coolers.

The ESW System, together with the UHS, satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii) (Ref. 4).

LCO

The ESW subsystems are independent of each other to the degree that each has separate controls, power supplies, and the operation of one does not depend on the other. In the event of a DBA, one subsystem of ESW is required to provide the minimum heat removal capability assumed in the safety analysis for the system to which it supplies cooling water. To ensure this requirement is met, two subsystems of ESW must be OPERABLE. At least one subsystem will operate, if the worst single active failure occurs coincident with the loss of offsite power.

A subsystem is considered OPERABLE when it has an OPERABLE UHS, one OPERABLE pump, and an OPERABLE flow path capable of taking suction from the intake structure and transferring the water to the appropriate equipment. OPERABILITY of equipment cooled by the ESW System is based on heat transfer, not flow rates; OPERABILITY of the ESW pumps is based on measured performance remaining within allowable IST Program acceptance criteria.

The OPERABILITY of the UHS is based on having a minimum water level in the screenwell of 236.5 ft mean sea level and a maximum water temperature of 85 °F. ~~With UHS temperature ≤ 37 °F, conditions become increasingly favorable for the formation of frazil ice on the intake structure bar racks during normal operation. Therefore, in an effort to suppress the formation of frazil ice on the intake structure bar racks, at least 18 out of the 44 deicing heaters (each heater producing 1670 ± 10% watts) in each electrical division are maintained OPERABLE whenever UHS temperature is ≤ 37 °F.~~

(continued)

BASES

LCO (continued)

The isolation of the ESW System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the ESW System.

APPLICABILITY

In MODES 1, 2, and 3, the ESW System and UHS are required to be OPERABLE to support OPERABILITY of the equipment serviced by the ESW System. Therefore, the ESW System and UHS are required to be OPERABLE in these MODES.

In MODES 4 and 5, the OPERABILITY requirements of the ESW System and UHS are determined by the systems they support and therefore, the requirements are not the same for all facets of operation in MODES 4 and 5. Thus, LCO 3.7.4, "Control Room AC System," and LCO 3.8.2, "AC Sources - Shutdown," which require the ESW System to be OPERABLE, will govern ESW System operation in MODES 4 and 5.

ACTIONS

A.1

With one ESW subsystem inoperable, the ESW subsystem must be restored to OPERABLE status within 7 days. With the plant in this condition, the remaining OPERABLE ESW subsystem is adequate to perform the heat removal function. However, the overall reliability is reduced because a single active component failure in the OPERABLE ESW subsystem could result in loss of ESW function.

The 7 day Completion Time is based on the redundant ESW System capabilities afforded by the OPERABLE subsystem, the low probability of an accident occurring during this time period, and is consistent with the allowed Completion Time for restoring an inoperable EDG subsystem.

Required Action A.1 is modified by a Note indicating that the applicable Conditions of LCO 3.8.1, "AC Sources - Operating," be entered and Required Actions taken if the inoperable ESW subsystem results in an inoperable EDG subsystem. This is in accordance with LCO 3.0.6 and ensures the proper actions are taken for this component.

~~B.1~~

~~With one division of deicing heaters inoperable, the deicing heaters~~

(continued)

BASES

ACTIONS

~~B.1 (continued)~~

~~must be restored to OPERABLE status within 7 days. With the plant in this condition, the remaining OPERABLE division of deicing heaters is adequate to perform the required function. However, the overall reliability of the deicing heaters is reduced.~~

~~The 7 day Completion Time is based on the redundant capabilities afforded by the OPERABLE division of deicing heaters, the low probability of an accident occurring during this time period, and is consistent with the allowed Completion Time for restoring an inoperable EDG subsystem.~~

B.1 and B.2 → ~~C.1 and C.2~~

If the ESW subsystem cannot be restored to OPERABLE status within the associated Completion Time, or both ESW subsystems are inoperable, or the UHS is determined inoperable the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.2.1

This SR verifies the water level in the screenwell to be sufficient for the proper operation of the ESW and RHRSW pumps (net positive suction head and pump vortexing are considered in determining this limit). The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.7.2.2

Verification of the UHS temperature ensures that the heat removal capability of the ESW System is within the assumptions of the DBA analysis. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~SR 3.7.2.3, SR 3.7.2.5, and SR 3.7.2.6~~

~~These SRs are modified by a NOTE indicating that these SRs are not required to be met if UHS temperature is > 37°F. Industry experience has shown that frazil ice will not adhere to the bar racks that are above freezing temperatures. Therefore at these elevated temperatures, blockage of the intake is unlikely and the deicing heaters are not required to be OPERABLE.~~

~~Verification of the required deicing feeder current in SR 3.7.2.3 and the required deicing heater power in SR 3.7.2.5 will help ensure that adequate heat is being provided at the bar racks to help ensure that frazil ice does not adhere to them. Verification of the required deicing heater resistance to ground in SR 3.7.2.6 is performed to monitor long term degradation of the cable and heater insulations. SR 3.7.2.3 can be performed by measuring the current in all three phases of the feeder cables to each division and ensuring the total current is within limits to confirm that at least 18 deicing heaters are OPERABLE in each division. SR 3.7.2.5 is performed to verify that at least 18 deicing heaters in each division are each dissipating at least 1503 watts (from Vendor Specification 1670 ±10% watts). The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

SR 3.7.2.3 → ~~SR 3.7.2.4~~

Verifying the correct alignment for each manual, power operated, and automatic valve in each ESW subsystem flow path provides assurance that the proper flow paths will exist for ESW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position, and yet considered in the correct position, provided it can be automatically realigned to its accident position within the required time. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

(continued)

BASES

SR 3.7.2.3

SURVEILLANCE REQUIREMENTS

~~SR 3.7.2.4~~ (continued)

This SR is modified by a Note indicating that isolation of the ESW System to components or systems may render those components or systems inoperable, but does not necessarily affect the OPERABILITY of the ESW System. As such, when all ESW pumps, valves, and piping are OPERABLE, but a branch connection off the main header is isolated, the ESW System may still be considered OPERABLE.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

SR 3.7.2.4 → ~~SR 3.7.2.7~~

This SR verifies the automatic start capability of the ESW pump in each subsystem. This is demonstrated by the use of an actual or simulated initiation signal associated with each EDG. In addition, the proper positioning of the ESW supply header isolation valves and the ESW minimum flow valves, upon actual or simulated ESW lockout matrix logic actuation, must be demonstrated in this SR. The LOGIC SYSTEM FUNCTIONAL TEST performed in LCO 3.3.7.3 overlaps this Surveillance to provide complete testing of the assumed safety function. ESW will not be supplied to the Reactor Building Closed Loop Cooling System during the performance of this test to avoid contaminating this system with lake water.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. UFSAR, Section 9.7.1.
2. UFSAR, Chapter 5.
3. UFSAR, Chapter 14.
4. 10 CFR 50.36(c)(2)(ii).