FINAL SAFETY EVALUATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TECHNICAL SPECIFICATIONS TASK FORCE TRAVELER

TSTF-566, REVISION 0

"REVISE ACTIONS FOR INOPERABLE RHR SHUTDOWN COOLING SUBSYSTEM"

USING THE CONSOLIDATED LINE ITEM IMPROVEMENT PROCESS

(EPID L-2018-PMP-0001)

1.0 INTRODUCTION

By letter dated January 19, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18019B187), the Technical Specifications Task Force (TSTF) submitted traveler TSTF-566, Revision 0, "Revise Actions for Inoperable RHR [Residual Heat Removal] Shutdown Cooling Subsystems." Traveler TSTF-566, Revision 0, proposed changes to the Standard Technical Specifications (STS) for boiling-water reactor (BWR) designs.[1] These changes would be incorporated into future revisions of NUREG-1433 and NUREG-1434.

The proposed changes would revise TS actions for inoperable RHR shutdown cooling subsystems in the RHR shutdown cooling system limiting conditions for operation (LCOs). This STS change will be made available to licensees through the consolidated line item improvement process.

2.0 REGULATORY EVALUATION

2.1 DESCRIPTION OF THE RESIDUAL HEAT REMOVAL SHUTDOWN COOLING SYSTEM

Irradiated fuel in the shutdown reactor core generates heat during the decay of fission products and increases the temperature of the reactor coolant. This decay heat must be removed to reduce the temperature of the reactor coolant to less than or equal to 200 degrees Fahrenheit (°F). This decay heat is removed by the RHR shutdown cooling system in preparation for performing refueling or maintenance operations, or for keeping the reactor in the hot shutdown condition or cold shutdown condition.

Typical BWR designs consist of two redundant, manually controlled shutdown cooling subsystems of the RHR system to provide decay heat removal. Each loop consists of one or

[1] U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, General Electric Plants, BWR/4," NUREG-1433, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12104A192 and ML12104A193, respectively).

U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, General Electric Plants, BWR/6," NUREG-1434, Volume 1, "Specifications," and Volume 2, "Bases," Revision 4.0, April 2012 (ADAMS Accession Nos. ML12104A195 and ML12104A196, respectively).

two motor-driven pumps, a heat exchanger, and associated piping and valves. The RHR heat exchangers transfer heat to the RHR service water system. Some piping and heat exchangers that are passive components may be common to both subsystems.

Technical Specification 3.4.8 for NUREG-1433 and TS 3.4.9 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown," are applicable in Mode 3 with reactor steam dome pressure lower than the RHR cut-in permissive pressure. Technical Specification 3.4.9 for NUREG-1433 and TS 3.4.10 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown," are applicable in Mode 4. They all require two operable RHR shutdown cooling subsystems and, with no recirculation pump in operation, at least one RHR shutdown cooling subsystem in operation.

2.2 PROPOSED CHANGES TO THE STANDARD TECHNICAL SPECIFICATIONS

The proposed changes would revise TS 3.4.8 for NUREG-1433 and TS 3.4.9 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown," and TS 3.4.9 for NUREG-1433 and TS 3.4.10 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown." The proposed changes are described below.

2.2.1 Proposed Changes to "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown"

Required actions for one or two RHR shutdown cooling subsystems inoperable (Condition A) of TS 3.4.8 for NUREG-1433 and TS 3.4.9 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown," require the operators to initiate action to restore RHR shutdown cooling subsystem(s) to operable status (Required Action A.1) immediately, verify an alternate method of decay heat removal is available for each inoperable RHR shutdown cooling subsystem (Required Action A.2) within 1 hour, and be in Mode 4 (Required Action A.3) within 24 hours.

Traveler TSTF-566, Revision 0, proposed to move Required Action A.1 to new Condition B (as Required Action B.1) and delete Required Action A.3. It also proposed to add a recurring completion time (CT) to current Required Action A.2 of "once per 24 hours thereafter." The traveler renumbers current Required Action A.2 as A.1, since Required Actions A.1 and A.3 are removed from Condition A.

Traveler TSTF-566, Revision 0, also proposed a new Condition B for when the required action and associated CT of Condition A are not met. New Condition B's Required Action B.1 is moved from current Required Action A.1 and requires operators to initiate action to restore RHR shutdown cooling subsystems(s) to operable status immediately.

Current Required Action A.2 was renumbered as A.1 since Required Actions A.1 and A.3 were deleted. Current Condition B and its required actions were renamed "C," "C.1," "C.2," and "C.3," respectively, since new Condition B was added. Conforming changes were also made to the STS Bases.

2.2.2 Proposed Changes to "Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown"

Required actions for one or two RHR shutdown cooling subsystems inoperable (Condition A) of TS 3.4.9 for NUREG-1433 and TS 3.4.10 for NUREG-1434, "Residual Heat Removal (RHR)

Shutdown Cooling System – Cold Shutdown," require the operators to verify an alternate method of decay heat removal is available for each inoperable RHR shutdown cooling subsystem (Required Action A.1) within 1 hour and once per 24 hours thereafter.

Traveler TSTF-566, Revision 0, proposed a new Condition B for when the required action and associated CT of Condition A is not met, which has a required action (new Required Action B.1) for operators to initiate action to restore RHR shutdown cooling subsystems(s) to operable status immediately.

Current Condition B and its required actions were renamed "C," "C.1," and "C.2," respectively, since new Condition B was added. Conforming changes were also made to the STS Bases.

2.3 APPLICABLE REGULATORY REQUIREMENTS AND GUIDANCE

Section IV, "The Commission Policy," of the "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors," published in the *Federal Register* on July 22, 1993 (58 FR 39132), states, in part:

> The purpose of Technical Specifications is to impose those conditions or limitations upon reactor operation necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety by identifying those features that are of controlling importance to safety and establishing on them certain conditions of operation which cannot be changed without prior Commission approval.
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> …[T]he Commission will also entertain requests to adopt portions of the improved STS [(e.g., TSTF-566)], even if the licensee does not adopt all STS improvements. …The Commission encourages all licensees who submit Technical Specification related submittals based on this Policy Statement to emphasize human factors principles.
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> …In accordance with this Policy Statement, improved STS have been developed and will be maintained for each NSSS [nuclear steam supply system] owners group. The Commission encourages licensees to use the improved STS as the basis for plant-specific Technical Specifications. …[I]t is the Commission intent that the wording and Bases of the improved STS be used … to the extent practicable.

The Commission Policy concerning Bases is, in part:

> Each LCO, Action, and Surveillance Requirement should have supporting Bases. The Bases should at a minimum address the following questions and cite references to appropriate licensing documentation (e.g., FSAR, Topical Report) to support the Bases.
>
> 1. What is the justification for the Technical Specification, i.e., which Policy Statement criterion requires it to be in the Technical Specifications?

> 2. What are the Bases for each LCO, i.e., why was it determined to be the lowest functional capability or performance level for the system or component in question necessary for safe operation of the facility and, what are the reasons for the Applicability of the LCO?
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> 3. What are the Bases for each Action, i.e., why should this remedial action be taken if the associated LCO cannot be met; how does this Action relate to other Actions associated with the LCO; and what justifies continued operation of the system or component at the reduced state from the state specified in the LCO for the allowed time period?

As described in the Commission's "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors," the NRC and industry task groups for new STS recommended that improvements include greater emphasis on human factors principles in order to add clarity and understanding to the text of the STS, and provide improvements to the Bases of STS, which provides the purpose for each requirement in the specification. The improved vendor-specific STS were developed and issued by the NRC in September 1992.

The regulation at Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36(b) requires:

> Each license authorizing operation of a … utilization facility … will include technical specifications. The technical specifications will be derived from the analyses and evaluation included in the safety analysis report, and amendments thereto, submitted pursuant to [10 CFR] 50.34 ["Contents of applications; technical information"]. The Commission may include such additional technical specifications as the Commission finds appropriate.

Per regulation at 10 CFR 50.40, "Common Standards:"

> In determining that [an] operating license … will be issued to an applicant, the Commission will be guided by the following considerations:
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> (a) … the processes to be performed, the operating procedures, the facility and equipment, the use of the facility, and other technical specifications, or the proposals, in regard to any of the foregoing collectively provide reasonable assurance that the applicant will comply with the regulations in this chapter, including the regulations in part 20 of this chapter, and that the health and safety of the public will not be endangered.

The NRC staff's guidance for the review of TSs is in Chapter 16.0, "Technical Specifications," of NUREG-0800, Revision 3, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR [Light-Water Reactor] Edition" (SRP), March 2010 (ADAMS Accession No. ML100351425). As described therein, as part of the regulatory standardization effort, the NRC staff has prepared STS for each of the LWR nuclear designs. Accordingly, the

NRC staff's review includes consideration of whether the proposed changes are consistent with the applicable reference STS (i.e., the current STS), as modified by NRC-approved travelers. In addition, the guidance states that comparing the change to previous STS can help clarify the TS intent.

3.0 TECHNICAL EVALUATION

3.1 PROPOSED CHANGES TO "RESIDUAL HEAT REMOVAL (RHR) SHUTDOWN COOLING SYSTEM – HOT SHUTDOWN"

In traveler TSTF-566, Revision 0, the TSTF proposed to modify TS 3.4.8 for NUREG-1433 and TS 3.4.9 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown." The technical evaluation of each change follows.

3.1.1 Evaluation of Changes to Condition A

Traveler TSTF-566, Revision 0, proposed to add a recurring CT to current Required Action A.2 of "once per 24 hours thereafter." Current Required Action A.2 requires verification that an alternate method of decay heat removal is available for each inoperable RHR shutdown cooling subsystem within 1 hour. The NRC staff finds this change is acceptable since it requires continuous verification of alternate methods of decay heat removal every 24 hours and provides assurance of continued heat removal capability.

Traveler TSTF-566, Revision 0, also proposed to delete current Required Action A.3 which requires the plant to be in Mode 4 within 24 hours when one or two RHR shutdown cooling subsystems are inoperable. Current Required Action A.3 requires operators to reduce the reactor coolant system temperature to the point where Mode 4 is entered due to the potentially reduced reliability of the alternate methods of decay heat removal. However, if there is no operable RHR shutdown cooling subsystem and the plant is in a period of high decay heat load, it may not be possible to reduce the reactor coolant system temperature to the Mode 4 entry condition (typically less than 200 °F) within the CT. In addition, in a typical BWR design, the RHR shutdown cooling system has a heat rejection capability many times greater than alternate methods available. Therefore, for periods in which there is high decay heat load, the BWR design does not include any system which can satisfy Required Action A.3. The NRC staff finds the deletion of current Required Action A.3 is acceptable because, at below the RHR cut-in permissive pressure, the remaining required action will continue to transfer fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded.

Current Required Action A.2 is renumbered as A.1, since Required Actions A.1 and A.3 are removed from Condition A. The NRC staff finds this change is acceptable since it provides the correct number sequence.

3.1.2 Evaluation of New Condition B

Traveler TSTF-566, Revision 0, proposed a new Condition B for when required action and associated CT of Condition A is not met. New Condition B's required action, B.1, is moved from current Required Action A.1 and requires operators to initiate action to restore RHR shutdown cooling subsystems(s) to operable status immediately. The NRC staff finds that relocating the required action from A.1 to new Required Action B.1 is acceptable because other ways of

removing decay heat are available, such as natural circulation, the spent fuel pool cooling system, the reactor water cleanup system, and an inoperable but functional RHR shutdown cooling subsystem.

If an alternate method cannot be established (Condition A), new Condition B requires the licensee to immediately initiate action to restore the inoperable RHR shutdown cooling subsystem(s) to operable status. The CT "immediately" is defined in Section 1.3 of the TSs as, "the Required Action should be pursued without delay and in a controlled manner." New Required Action B.1 continues to apply until the inoperable RHR shutdown cooling subsystems are restored to operable status, an alternate decay heat removal method is established, or the specification is exited.

The NRC staff finds this change is acceptable because new Condition B with its Required Action B.1 provide an appropriate action for when an alternate method cannot be established within the CT. In addition, new Required Action B.1 will restore redundant decay heat removal paths and the immediate CT reflects the importance of maintaining the availability of two paths for heat removal.

3.1.3 Evaluation of Changes to Existing Condition B

Current Required Action A.2 was renumbered as A.1, since Required Actions A.1 and A.3 were deleted. Current Condition B and its required actions were renamed "C," "C.1," "C.2," and "C.3," respectively, since new Condition B was added. The NRC staff finds this change is acceptable since it provides the correct number sequence.

3.1.4 Conclusion of Proposed Changes to "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown"

The NRC staff concludes the proposed changes are acceptable since the remedial actions provide reasonable assurance that the health and safety of the public will not be endangered.

3.2 PROPOSED CHANGES TO "RESIDUAL HEAT REMOVAL (RHR) SHUTDOWN COOLING SYSTEM – COLD SHUTDOWN"

In Traveler TSTF-566, Revision 0, the TSTF proposed to modify TS 3.4.9 for NUREG-1433 and TS 3.4.10 for NUREG-1434, "Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown." The technical evaluation of each change follows.

3.2.1 Evaluation of New Condition B

Traveler TSTF-566, Revision 0, proposed a new Condition B for when the required action and associated CT of Condition A is not met which has a required action (new Required Action B.1) for operators to initiate action to restore RHR shutdown cooling subsystems(s) to operable status immediately.

If an alternate method cannot be established (Condition A), new Condition B requires the licensee to immediately initiate action to restore the inoperable RHR shutdown cooling subsystem(s) to operable status. The CT "immediately" is defined in Section 1.3 of the TSs as, "the Required Action should be pursued without delay and in a controlled manner." New Required Action B.1 continues to apply until the inoperable RHR shutdown cooling subsystems

are restored to operable status, an alternate decay heat removal method is established, or the specification is exited.

The NRC staff finds this change is acceptable because new Condition B with its Required Action B.1 provides an appropriate terminal action for when an alternate method cannot be established within the CT. In addition, new Required Action B.1 will restore redundant decay heat removal paths and the immediate CT reflects the importance of maintaining the availability of two paths for heat removal.

3.2.2 Evaluation of Changes to Existing Condition B

Current Condition B and its required actions were renamed "C," "C.1," and "C.2," respectively, since new Condition B was added. The NRC staff finds this change is acceptable since it provides the correct number sequence.

3.2.3 Conclusion of Proposed Changes to "Residual Heat Removal (RHR) Shutdown Cooling System – Cold Shutdown"

The NRC staff concludes the proposed changes are acceptable since the remedial actions provide reasonable assurance that the health and safety of the public will not be endangered.

3.3 CONSIDERATION OF CHANGES TO THE STANDARD TECHNICAL SPECIFICATION BASES

Traveler TSTF-566, Revision 0, proposed changes to the STS Bases that conformed to the TS changes made; specifically, moving Action A.1 and renumbering it as B.1, and renumbering the other actions accordingly. The proposed changes to the STS Bases explain that if the required alternate method(s) of decay heat removal cannot be verified within 1 hour as required by Action A.1, immediate action must be taken to restore the inoperable RHR shutdown cooling subsystem(s). It continues by stating that the new required action will restore redundant decay heat removal paths and its immediate CT reflects the importance of maintaining the availability of two paths for heat removal. The NRC staff finds the Bases for each Action acceptable because they are editorial in nature (movement of existing wording and renumbering to match new TS numbering) and continue to provide the reasons or bases for the specifications, as described in 10 CFR 50.36(a). The Bases for addition of a recurring CT for Action A.2 of "once per 24 hours thereafter," is acceptable based on engineering judgement because the continuous verification will provide assurance of continued heat removal capability.

In addition, TSTF-566, Revision 0, proposed changes to the STS Bases justifying the use of an inoperable but functional RHR shutdown cooling subsystem as an alternate method of decay heat removal provided it remains functional and has the capability to maintain or reduce reactor coolant system temperature. These proposed changes are acceptable since the RHR shutdown cooling subsystem is still functional and remains as capable as the alternate methods of decay heat removal listed in the TS Bases. In addition, removal of RCS decay heat is the primary function of the RHR shutdown cooling system, making it the preferred alternative over other systems with significantly lower heat removal capability. Also, the proposed STS Bases changes remove the verification by calculation or demonstration of the capability of an alternate method of decay heat removal to maintain or reduce temperature. This change is acceptable since a more appropriate criterion is that the alternate method of decay heat removal be capable of maintaining or reducing reactor coolant temperature, which can be determined without an explicit calculation or demonstration.

4.0 CONCLUSION

The NRC staff reviewed Traveler TSTF-566, Revision 0, which proposed changes to NUREG-1433 and NUREG-1434. The NRC staff determined that the proposed changes to the STS continue to meet the Commission's "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors" and 10 CFR 50.36. Additionally, the changes to the STS were reviewed and found to be technically clear and consistent with customary terminology and format in accordance with SRP Chapter 16.0. The NRC staff reviewed the proposed changes to the action statements and concludes that the changes continue to provide reasonable assurance and protection of the health and safety of the public. Therefore, the NRC staff concludes that the proposed TS changes are acceptable.

Principal Contributors: C. Tilton, NRR/DSS
M. Razzaque, NRR/DSS

Date: