

FINAL SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TECHNICAL SPECIFICATIONS TASK FORCE TRAVELER

TSTF-580, REVISION 1

“PROVIDE EXCEPTION FROM ENTERING MODE 4

WITH NO OPERABLE RHR SHUTDOWN COOLING”

USING THE CONSOLIDATED LINE ITEM IMPROVEMENT PROCESS

(EPID L-2020-PMP-0012)

1.0 INTRODUCTION

By letter dated January 26, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21025A232), the Technical Specifications Task Force (TSTF) submitted Traveler TSTF-580, Revision 1, “Provide Exception from Entering Mode 4 With No Operable RHR [Residual Heat Removal] Shutdown Cooling,” to the U.S. Nuclear Regulatory Commission (NRC). Traveler TSTF-580, Revision 1, proposed changes to the Standard Technical Specifications (STS) for boiling-water reactor (BWR) designs.<sup>1</sup> These changes would be incorporated into future revisions of NUREG-1433 (BWR/4) and NUREG-1434 (BWR/6).

The proposed changes would revise the “RHR Shutdown Cooling System – Hot Shutdown,” specification by adding an exception to entering Mode 4 if both required RHR shutdown cooling subsystems are inoperable. This STS change will be made available to licensees through the consolidated line item improvement process (CLIP).

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

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<sup>1</sup> 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.

STS 3.4.8 for BWR/4 and STS 3.4.9 for BWR/6, "Residual Heat Removal (RHR) Shutdown Cooling System – Hot Shutdown," are applicable in Mode 3 when the reactor steam dome pressure is lower than the RHR cut-in permissive pressure. This limiting condition for operation (LCO) for both STS requires two operable RHR shutdown cooling subsystems and, if no recirculation pump is in operation, then at least one RHR shutdown cooling subsystem is required to be in operation.

## 2.2 Proposed Changes to the Standard Technical Specifications

The changes proposed to STS 3.4.8 for BWR/4 and STS 3.4.9 for BWR/6 are identical. The evaluation below is applicable to both.

Condition A currently applies to "One or two RHR shutdown cooling subsystems inoperable" and has a Required Action to "Verify an alternate method of decay heat removal is available for each inoperable RHR shutdown cooling subsystem." TSTF-580 proposed to limit Condition A to a single inoperable subsystem by modifying it to state: "One [required] RHR shutdown cooling subsystem inoperable" with a Required Action to "Verify an alternate method of decay heat removal is available."

Condition B addresses situations when Required Action A.1 and the associated completion time (CT) are not met. TSTF-580 proposed to delete the plural "(s)" in Required Action B.1 as a conforming change to Condition A which now addresses a single inoperable RHR shutdown cooling subsystem.

TSTF-580 proposed to add a new Condition C which addresses two RHR shutdown cooling subsystems inoperable with a Required Action C.1 to verify an alternate method of decay heat removal is available for each inoperable RHR shutdown cooling subsystem. The Required Action for new Condition C has a CT of 1 hour and once per 24 hours thereafter.

TSTF-580 also proposed a new Condition D to address situations when new Required Action C.1 and associated CT are not met. New Required Action D.1 requires action be initiated to restore one RHR shutdown cooling subsystem to operable status immediately. Required Action D.1 is modified by a note that states that LCO 3.0.3 and all other LCO Required Actions requiring a mode change to Mode 4 may be suspended until one RHR shutdown cooling subsystem is restored to operable status.

Existing Condition C and associated Required Actions were renumbered as Condition E and Required Actions E.1, E.2, and E.3, respectively, as a result of new Conditions C and D.

## 2.3 Applicable Regulatory Requirements and Guidance

As described in the Commission's "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors" (58 FR 39132, dated July 22, 1993), the NRC and industry task groups for new STSs recommended that improvements include greater emphasis on human factors principles in order to add clarity and understanding to the text of the STSs, and provide improvements to the Bases of the STSs, which provides the purpose for each

requirement in the STSs. The improved vendor-specific STSs were developed and issued by the NRC in September 1992.

Section IV, "The Commission Policy," of the Final Policy Statement on Technical Specifications (TSs) 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.

...[T]he Commission will also entertain requests to adopt portions of the improved STS [(e.g., TSTF-580)], 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.

...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 Summary section of the Final Policy Statement on TS states, in part:

Implementation of the Policy Statement through implementation of the improved STS is expected to produce an improvement in the safety of nuclear power plants through the use of more operator-oriented Technical Specifications, Improved Technical Specification Bases, reduced action statement induced plant transients, and more efficient use of NRC and industry resources.

The Final Policy Statement on TS provides the following description of the scope and the purpose of the STS Bases:

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., Updated Final Safety Analysis Report (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?
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?
4. What are the Bases for each Safety Limit?
5. What are the Bases for each Surveillance Requirement and Surveillance Frequency; i.e., what specific functional requirement is the surveillance designed to verify? Why is this surveillance necessary at the specified frequency to assure that the system or component function is maintained, that facility operation will be within the Safety Limits, and that the LCO will be met?

Note: In answering these questions the Bases for each number (e.g., Allowable Value, Response Time, Completion Time, Surveillance Frequency), state, condition, and definition (e.g., operability) should be clearly specified. As an example, a number might be based on engineering judgment, past experience, or PSA [probabilistic safety assessment] insights; but this should be clearly stated.

The regulation under paragraph 50.36(a)(1) of Title 10 of the *Code of Federal Regulations* (10 CFR) requires that:

Each applicant for a license authorizing operation of a ... utilization facility shall include in his application proposed technical specifications in accordance with the requirements of this section. A summary statement of the bases or reasons for such specifications, other than those covering administrative controls, shall also be included in the application, but shall not become part of the technical specifications.

The regulation under 10 CFR 50.36(b) requires that:

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.

The categories of items required to be in the TSs are listed in 10 CFR 50.36(c). The regulation at 10 CFR 50.36(c)(2) requires that TSs include LCOs. Per 10 CFR 50.36(c)(2)(i), LCOs “are the lowest functional capability or performance levels of equipment required for safe operation of the facility.” The regulation also requires that when an LCO of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the TS until the condition can be met.

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 STSs 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 referenced STS, as modified by NRC-approved travelers. In addition, the SRP states that comparing the change to previous STSs can help clarify the STS intent.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Evaluation of Changes to Condition A

TSTF-580 proposed to split existing Condition A between revised Condition A, which now addresses a single inoperable RHR shutdown cooling subsystem, and new Condition C, evaluated in Section 3.3 below.

This change is acceptable because it does not alter the way the TS are implemented for a single inoperable RHR shutdown cooling subsystem.

#### 3.2 Evaluation of Changes to Required Action B.1

TSTF-580 revised existing Required Action B.1 to initiate action to restore a single inoperable RHR shutdown cooling subsystem.

This change is acceptable because it is a conforming change resulting from the revision to existing Condition A and does not alter the way the TS are implemented for a single inoperable RHR shutdown cooling subsystem.

#### 3.3 Evaluation of New Condition C

New Condition C addresses two RHR shutdown cooling subsystems inoperable with a Required Action C.1 to verify an alternate method of decay heat removal is available for each inoperable RHR shutdown cooling subsystem and a CT of 1 hour and once per 24 hours thereafter.

This change is acceptable because, together with revised Condition A, it preserves the existing Condition A and does not alter the way the TS are implemented for two inoperable RHR shutdown cooling subsystems.

#### 3.4 Evaluation of New Condition D

New Condition D addresses situations when new Required Action C.1 and associated CT are not met and requires immediate action be initiated to restore one RHR shutdown cooling subsystem to operable status. Required Action D.1 is modified by a note stating that LCO 3.0.3

and all other LCO Required Actions requiring a mode change to Mode 4 may be suspended until one RHR shutdown cooling subsystem is restored to operable status. The CT “immediately” is defined in Section 1.3 of the STSs as, “the Required Action should be pursued without delay and in a controlled manner.” New Required Action D.1 continues to apply until an inoperable RHR shutdown cooling subsystem is 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, without an operable RHR shutdown cooling subsystem and 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. Under this condition, remaining in Mode 3 allows fission product decay heat and other residual heat from the reactor core to be transferred at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary will not be exceeded. The CT reflects the importance of restoring a normal path for heat removal. Therefore, the NRC staff finds that proposed new Condition D, including its associated Required Action A.1 and CT, is acceptable because it continues to meet the requirements of 10 CFR 50.36(c)(2)(i), by providing remedial actions and shutting down the reactor if the remedial actions cannot be met.

### 3.5 Evaluation of Changes to Renumbered Condition E

Current Condition C and its Required Actions were renamed as Condition E, and Required Actions E.1, E.2, and E.3, respectively, since new Conditions C and D were added.

The NRC staff finds this change is acceptable since it is editorial and provides the correct number sequence.

### 3.6 Consideration of Changes to the STS Bases

The NRC staff reviewed the proposed changes to the STS Bases of STS 3.4.8 for NUREG-1433 (BWR/4) and STS 3.4.9 for NUREG-1434 (BWR/6) in TSTF-580, Revision 1. As discussed in Section 2.3 of this SE, the Final Policy Statement on TS describes the scope and purpose of the STS Bases. It does so by listing five questions the STS Bases must address. While the STS Bases as a whole must address these questions, not every question will be relevant to every change to the STS Bases. The second, fourth, and fifth questions are not relevant to this evaluation because the STS changes proposed in TSTF-580, Revision 1, as evaluated above, do not affect the LCO or its Applicability Bases, safety limits, or surveillance requirements. Since the proposed change only affects Actions, the Policy Statement criterion that applies to the LCO is not affected and the first question is not relevant to this evaluation. The proposed STS Bases support new action statements as well as revised action statements; therefore, the third question is relevant to the changes.

In TSTF-580, Revision 1, existing Condition A was split between revised Condition A and new Condition C, and therefore, information pertaining to new Required Action C.1 currently in the Bases for existing Required Action A.1 was deleted and moved to the Bases of new Required Action C.1. This change does not alter the clarification of the actions and is therefore acceptable. Under the Bases of Required Action A.1, the Spent Fuel Pool Cooling System was deleted as one of the alternate methods that can be used to meet the Required Action. This change is acceptable since the Spent Fuel Pool Cooling System cannot be credited as an alternate method to RHR shutdown cooling when the reactor vessel head is on.

Under the Bases of Required Action B.1, the ending "s," denoting more than one subsystem, was removed since revised B.1 now only applies to a single subsystem inoperable. This change is acceptable since it conforms with the changes to Required Action B.1.

A new paragraph was added under the Bases of new C.1 which is duplicative of a paragraph contained in existing A.1. This change is adequate since new C.1 was part of existing A.1 and the information contained in this paragraph continues to apply to new C.1.

Two new paragraphs were added to support the addition of new Required Action D.1. The first paragraph explains that if Required Action C.1 is not met, immediate action must be taken to restore the operability to at least one RHR shutdown cooling subsystem. It further justifies the immediate CT as it shows the importance of restoring a method of heat removal. The second paragraph explains the reason for the note which suspends all required mode changes to Mode 4 until at least the operability of one RHR shutdown cooling subsystem is restored. This justification is adequate since entry into Mode 4 without an operable RHR shutdown cooling subsystem is a less safe condition if there are no adequate means to remove decay heat. It is also made clear that when at least one RHR subsystem is restored to operable status, the CTs of LCO 3.0.3 or other Required Actions resume at the point at which they were suspended. The two paragraphs added to the Bases of new Required Action D.1 are acceptable since they clarify the reason for the remedial action and accompanying note. The explanation for the note adequately justifies continued operation at the reduced state.

The heading for the Bases of Required Actions C.1, C.2, and C.3 was renumbered as E.1, E.2, and E.3, respectively, since new Required Actions C.1 and D.1 were added. This change is acceptable since it is editorial and appropriately follows the structure of the document.

The NRC staff finds the proposed STS Bases changes acceptable as they adequately address Question 3 with regard to the new action statements and are consistent with the Final Policy Statement on TS and 10 CFR 50.36. Furthermore, the NRC staff review determined that the proposed STS Bases changes enhance and/or clarify the current STS Bases.

#### 4.0 CONCLUSION

The NRC staff finds that the changes to STS 3.4.8 for BWR/4 and STS 3.4.9 for BWR/6 satisfy 10 CFR 50.36(c)(2)(i) because the remedial actions to be taken until each LCO can be met provide protection to the health and safety of the public. Additionally, the NRC staff determined that the changes are technically clear and consistent with customary terminology and format in accordance with SRP Chapter 16.0.

Therefore, the NRC staff concludes that all the proposed changes in TSTF-580, Revision 1, are acceptable and thus, approved.

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

Date: