



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

October 24, 2018

ANO Site Vice President
Arkansas Nuclear One
Entergy Operations, Inc.
N-TSB-58
1448 S.R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 - ISSUANCE OF AMENDMENT RE:
REVISION TO TECHNICAL SPECIFICATION BASES RELATED TO
EMERGENCY FEEDWATER TURBINE-DRIVEN PUMP STEAM SUPPLY
VALVES (EPID L-2017-LLA-0349)

Dear Sir or Madam:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 261 to Renewed Facility Operating License No. DPR-51 for Arkansas Nuclear One, Unit 1 (ANO-1). The amendment consists of changes to the Technical Specification (TS) Bases in response to your application dated October 2, 2017, as supplemented by letters dated April 26 and August 10, 2018.

The amendment revises the ANO-1 TS Bases for TS 3.7.5, "Emergency Feedwater (EFW) System," to identify the conditions in which the TS 3.7.5, Condition A 7-day Completion Time (CT) and the Condition C 24-hour CT should apply to the ANO-1 turbine-driven EFW pump steam supply valves.

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

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas J. Wengert".

Thomas J. Wengert, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosures:

1. Amendment No. 261 to DPR-51
2. Safety Evaluation

cc: Listserv



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

ENTERGY ARKANSAS, INC.

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-313

ARKANSAS NUCLEAR ONE, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 261
Renewed License No. DPR-51

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Entergy Operations, Inc. (the licensee), dated October 2, 2017, as supplemented by letters dated April 26, 2018, and August 10, 2018, 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, by Amendment No. 261, Renewed Facility Operating License No. DPR-51 is hereby amended to authorize revision to the Arkansas Nuclear One, Unit 1, Technical Specification (TS) Bases, as set forth in the Entergy Operations, Inc. application dated October 2, 2017, as supplemented by letters dated April 26, 2018, and August 10, 2018. The licensee shall update the TS Bases to incorporate the changes as described in the licensee's application dated October 2, 2017, as supplemented by letters dated April 26, 2018, and August 10, 2018, and the NRC staff's safety evaluation dated October 24, 2018.
3. The license amendment is effective as of its date of issuance and shall be implemented within 60 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Date of Issuance: October 24, 2018



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 261 TO

RENEWED FACILITY OPERATING LICENSE NO. DPR-51

ENTERGY ARKANSAS, INC.

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 1

DOCKET NO. 50-313

1.0 INTRODUCTION

By application dated October 2, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17275A910), as supplemented by letters dated April 26 and August 10, 2018 (ADAMS Accession Nos. ML18117A492 and ML18222A551, respectively), Entergy Operations, Inc. (Entergy, the licensee) requested changes to the Arkansas Nuclear One, Unit 1 (ANO-1) Technical Specification (TS) Bases for TS 3.7.5, "Emergency Feedwater (EFW) System." The proposed change would revise the TS Bases to identify the conditions in which the TS 3.7.5, Condition A 7-day Completion Time (CT) and the Condition C 24-hour CT should apply to the ANO-1 turbine-driven (TD) EFW pump steam supply valves.

The 7-day and 24-hour CTs are known to apply to the alternating current (AC)-powered TD EFW pump steam supply, but it is unclear in the existing TS Bases whether the 7-day and 24-hour CTs can be applied to the direct current (DC)-powered steam supply and bypass motor-operated valves (MOVs). Since historical correspondence does not clearly stipulate the inclusion of the DC-powered steam supply MOVs in application of the CT, Entergy requested the U.S. Nuclear Regulatory Commission's (NRC's or the Commission's) review and approval of an amendment to the TS Bases to clearly indicate the applicability of the 7-day CT and 24-hour CT to all four TD EFW pump DC MOV steam supply valves, regardless of power supply.

The supplemental letters dated April 26 and August 10, 2018, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on December 5, 2017 (82 FR 57473).

2.0 REGULATORY EVALUATION

2.1 System Description

The EFW system automatically supplies feedwater to the steam generators (SGs) to remove decay heat upon loss of normal feedwater. The ANO-1 EFW system consists of two, full-capacity, independent trains, one containing a TD pump (P-7A) and the other an electric-driven pump (P-7B). The electric-driven pump (P-7B) is supported by 4160 volts AC vital power, backed by an emergency diesel generator and is considered a "red AC" train, although there are DC interfaces. Conversely, the TD pump (P-7A) is supplied steam from either or both SGs and is considered a "green DC" train, although there are red train DC interfaces and AC interfaces. Each pump has the flow capacity to remove heat load equal to 3.5 percent of full power. The total required feedwater can be supplied to either SG from either pump.

The TD pump (P-7A) has two steam supplies, one from each SG, upstream of the main steam stop valves. Each steam supply line has a normally open AC MOV off each of the SG steam lines. Downstream of the AC MOVs, the steam lines combine into one header and then divide into two lines, each with two DC-operated MOVs.

2.2 Description of Proposed Change

TS Bases 3.7.5, Action A.1, currently reads, in part:

With one of the two steam supplies to the turbine driven EFW pump inoperable, or if the turbine driven EFW pump is inoperable in MODE 3 immediately following refueling, action must be taken to restore the steam supply to OPERABLE status within 7 days. The 7-day Completion Time is reasonable, based on the following reasons:

...

The licensee proposes to change TS Bases 3.7.5, Action A.1 to read, in part [proposed changes are underlined for clarification only]:

With one of the two steam supply paths to the turbine driven EFW pump inoperable, or if the turbine driven EFW pump is inoperable in MODE 3 immediately following refueling, action must be taken to restore the steam supply to OPERABLE status within 7 days. An OPERABLE steam supply path must include an OPERABLE AC-powered steam supply valve (CV-2617 or CV-2667), an OPERABLE DC-powered steam supply valve (CV-2613 or CV-2663), and an OPERABLE DC-powered steam supply bypass valve (CV-2615 or CV-2665). The 7-day Completion Time is reasonable, based on the following reasons:

...

TS Bases 3.7.5, Actions C.1 and C.2, currently reads, in part:

With the required motor driven EFW train (pump or flow path) inoperable and one of the turbine driven EFW trains inoperable due to one inoperable steam supply, action must be taken to restore the affected equipment to OPERABLE status

within 24 hours. Assuming no single active failures when in this condition, the accident (a FWLB [feedwater line break] or MSLB [main steam line break]) could result in the loss of the remaining steam supply to the inoperable turbine driven EFW pump due to the faulted SG. In this condition, the EFW system may no longer be able to meet the required flow to the SGs assumed in the safety analysis.

...

The licensee proposes to change TS Bases 3.7.5, Actions C.1 and C.2, to read, in part [proposed changes are underlined for clarification only]:

With the required motor driven EFW train (pump or flow path) inoperable and ~~one~~ of the turbine driven EFW trains inoperable due to one inoperable steam supply, action must be taken to restore the affected equipment to OPERABLE status within 24 hours. With respect to the turbine driven EFW train, an OPERABLE steam supply path must include an OPERABLE AC-powered steam supply valve (CV-2617 or CV-2667), an OPERABLE DC-powered steam supply valve (CV-2613 or CV-2663), and an OPERABLE DC-powered steam supply bypass valve (CV-2615 or CV-2665). Assuming no single active failures when in this condition, the accident (a FWLB or MSLB) could result in the loss of the remaining steam supply to the inoperable turbine driven EFW pump due to the faulted SG. In this condition, the EFW system may no longer be able to meet the required flow to the SGs assumed in the safety analysis.

2.3 Regulatory Review

Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.36(a)(1) states, "Each applicant for a license authorizing operation of a production or 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."

NRC Information Notice 97-80, "Licensee Technical Specifications Interpretations," dated November 21, 1997, states, in part:

Licensees should be aware that there are several NRC recognized methods for resolving TS questions or clarifying TS requirements. Licensees are encouraged to pursue one of these methods when they have a question concerning TS compliance and want the NRC to formally recognize their position. The methods include (1) amending the license to change the TS wording; (2) revising the TS bases via 10 CFR 50.59 or 50.90 (when an unreviewed safety question is identified) to clarify the TS requirement; or (3) formally requesting a written interpretation from the Office of Nuclear Reactor Regulation (NRR) regarding the intent of the TS requirement (for clarity these are referred to as "NRC-approved TS interpretations)."

Revision 4 of NUREG-1430, "Standard Technical Specifications Babcock and Wilcox Plants," Volume 2, Bases, dated April 2012 (ADAMS Accession No. ML12100A178), B3.7.5,

“Emergency Feedwater (EFW) System,” the limiting condition for operation (LCO) section states, in part:

The EFW System is considered to be OPERABLE when the components and flow paths required to provide EFW flow to the steam generators are OPERABLE. This requires that the [two] turbine driven EFW pump(s) be OPERABLE with redundant steam supplies from each of the main steam lines upstream of the MSIVs [main steam isolation valves] and capable of supplying EFW flow to either of the two steam generators.

3.0 TECHNICAL EVALUATION

3.1 Technical Review

The ANO-1 TS 3.7.5 LCO requires two EFW trains to be OPERABLE when in MODES 1, 2, 3 and 4 (when the SG is relied upon for heat removal). For both EFW trains to be considered operable, among other requirements, the TD EFW pump must have two steam supplies (one from each of the main steam lines upstream of the MSIVs). If one steam supply is inoperable, the licensee is required to enter Condition A of TS 3.7.5 with a 7-day CT to restore the affected equipment to operable status.

The 7-day CT is known to apply to the two AC-powered TD EFW pump steam supply MOVs (CV-2667 and CV-2617) that branch off the two SGs, but it is unclear whether the 7-day CT can be applied to the DC-powered steam supply MOVs that are in series and downstream of the AC MOVs. Therefore, the licensee requested that the NRC review and approve an amendment to the subject TS Bases, which would clearly indicate the applicability of the 7-day CT to all four TD EFW pump steam supply valves, regardless of power supply.

The licensee’s proposed addition, as described in Section 2.2 of this safety evaluation, allows a steam supply to the TD EFW pump to be considered operable regardless of the power supply to the associated MOVs within that steam path. In the past, the licensee has conservatively interpreted TS 3.7.5 such that if any DC-powered MOV within the steam supply to the TD EFW pump is inoperable, then the TD EFW pump is considered inoperable and Condition B is entered where the CT is 72 hours. The proposed TS Bases change would allow the licensee to enter Condition A, where the CT is 7 days, when any steam path is operable, although one or more DC MOVs are inoperable. An operable steam path would consist of one AC MOV, a DC-powered bypass MOV, and main steam path DC MOV regardless of whether each MOV was powered from a red or green source.

In defining an operable steam path as any AC MOV, DC bypass MOV, and DC supply MOV, the remaining AC and DC MOVs could be inoperable in any valve position. Therefore, in an e-mail request for additional information (RAI) dated July 18, 2018 (ADAMS Accession No. ML18199A323), the NRC staff questioned the effect on the TD EFW pump governor function of inoperable MOVs in various positions. By letter dated August 10, 2018, the licensee responded, stating that an inoperable open AC MOV would cause entry into TS 3.6.3, “Reactor Building Isolation Valves,” and an inoperable closed AC MOV would cause entry into TS 3.7.5, Condition A. The licensee also stated that an inoperable DC steam supply MOV that is not closed would cause the licensee to deactivate the AC MOVs closed and enter into TS 3.7.5, Condition B, for an inoperable EFW train. An inoperable DC steam supply MOV that is closed would cause entry into TS 3.7.5, Condition A, as requested. The licensee also stated that an inoperable DC bypass MOV that is not closed would cause the licensee to shut the AC MOVs to

prevent turbine spin. An inoperable DC bypass MOV that is closed would cause entry into TS 3.7.5, Condition A, as requested. Based on the foregoing, the licensee accounts for the valve position of inoperable AC and DC MOVs on the TD EFW pump and, therefore, the NRC staff concludes that the licensee's response is acceptable.

The NRC staff also questioned whether crediting an operable steam path consisting of valves from both red and green power supplies, as the licensee requested, would adversely affect the timing sequence of valve operation and thus jeopardize satisfactory startup of the TD EFW pump. Therefore, in the RAI dated July 18, 2018, the NRC staff asked the licensee to describe how existing surveillance testing would provide reasonable assurance that each proposed OPERABLE steam path supply would satisfactorily automatically start and operate the TD EFW pump. In its letter dated August 10, 2018, the licensee stated that surveillance testing verifies that automatic valves (both red and green powered valves) actuate and that the EFW pumps start automatically on an actual or simulated signal. Additionally, the licensee stated that quarterly inservice testing of valve stroke time is performed to ensure overall engineered safeguards response time testing is not invalidated should valve degradation occur during the operating cycle. This testing, in conjunction with the fact that main DC-powered steam supply valves do not rely upon the position of the DC bypass valves to open makes the power train supporting any of these valves have no effect on valve response or pump start sequencing. Based on the foregoing, the NRC staff concludes that the licensee's response to this concern is acceptable.

The licensee's proposed definition of an operable steam path and associated 7-day CT is in alignment with NUREG-1430, Revision 4, because the proposed definition of an operable steam path would provide a steam supply to the TD EFW pump. For additional defense-in-depth considerations, the licensee performed an analysis that evaluated EFW response to accidents where the only operable steam path to the TD EFW pump is in accordance with the licensee's proposed definition of an operable steam path and an additional single failure is assumed. The purpose of the analysis was to determine whether there could possibly be a loss of safety function in the EFW system or whether the proposed change in CT application from 72 hours to 7 days was risk significant. The licensee's failure analysis is conservative by assuming a worst-case single failure when already in a TS Action statement. The design-basis accidents (DBAs) considered were those for which the EFW system was designed to mitigate (i.e., (1) loss of offsite power, (2) loss of all AC power (LOAC), (3) main feedwater line break, (4) MSLB, and (5) small-break loss of coolant accident.

The licensee determined in its analysis that when having one steam path operable to the TD EFW pump, as proposed in the license amendment request, the EFW system remains capable of fulfilling its safety function assuming a single active failure following the onset of an accident, except in three scenarios. The three scenarios would not have automatic initiation of EFW, but would rely upon manual action to start EFW. The three scenarios are (1) an LOAC with failure of the remaining operable DC bypass or full flow steam DC MOV, (2) any EFW-associated DBA with an emergency feedwater initiation and control Channel A or Red Train DC failure, and (3) an MSLB associated with the SG that would supply the only remaining steam path when the other steam path is not OPERABLE with a subsequent failure of the motor-driven EFW pump. The manual actions that would activate EFW in the above scenarios are either manually opening DC-powered MOVs locally or remotely operating MOVs from the control room, or manually starting the motor-driven EFW pump, or using the station blackout diesel generator to restore power to the motor-driven EFW pump.

For these three scenarios, the NRC staff does not concur that manual initiation of EFW is an acceptable accident mitigation action because Section 10.4.8, "Emergency Feedwater System," of the ANO-1 Safety Analysis Report describes EFW actuation within 80 seconds for accident mitigation. The staff's regulatory position on manual action following a DBA does not credit actions that are required to be performed within 80 seconds after a DBA. Additionally, the ANO-1 TS 3.7.5 Bases and NUREG-1430 TS 3.7.5 credit one of the two steam supplies to the TD EFW pump as a basis for allowing a 7-day CT, in part, on the redundant operable motor-driven EFW pump. The staff considers crediting the redundant motor-driven EFW pump, dependent on the design features of the pump, which includes automatic operation. Therefore, crediting manual initiation of an EFW pump within 80 seconds is not an acceptable accident mitigation acceptance criterion.

However, the NRC staff considers the aforementioned three scenarios and subsequent single failures within the added CT from 3 days to 7 days to be highly unlikely using traditional engineering and regulatory analysis with a defense-in-depth perspective. The assumption of an additional failure after the accident, as assumed in the licensee's analysis, while already in a TS 3.7.5 Action statement, although increased from 3 days to 7 days, is still highly conservative. The plant would be susceptible to these highly unlikely scenarios for 72 hours anyway. Increasing the CT to 7 days for these highly unlikely scenarios is not risk significant. Furthermore, the NRC staff performed an independent assessment using the ANO-1 Standardized Plant Analysis Risk (SPAR) model to evaluate the risk contribution from internal and external events. The SPAR model insights and results supported the engineering conclusions that the licensee's proposed description of an operable steam path to the TD EFW pump could be used to enter Condition A of TS 3.7.5 and its associated CT of 7 days.

The NRC staff noted that a definition for an operable steam path for Condition C had not been defined similar to that proposed for Condition A. Therefore, in the NRC staff RAI dated July 18, 2018, the staff asked the licensee to define what constitutes an operable steam path when in Condition C. The licensee responded by letter dated August 10, 2018, stating that the operable steam path, as defined for Condition A, is the same as that for Condition C. The NRC staff concludes that the licensee's response is acceptable.

Based on the above, the NRC staff has determined that the licensee's proposed TS Bases changes are in alignment with NUREG-1430, Revision 4, Volume 2, and are supported by an independent risk analysis performed by the NRC staff. The staff concludes that an operable steam path can be defined as an OPERABLE AC-powered steam supply valve (CV-2617 or CV-2667), an OPERABLE DC-powered steam supply valve (CV-2613 or CV-2663), and an OPERABLE DC-powered steam supply bypass valve (CV-2615 or CV-2665) and that this definition applies to both ANO-1 TS 3.7.5 Condition A and Condition C.

3.2 Technical Evaluation Conclusion

Based on the foregoing, the NRC staff concludes that the licensee's analysis of EFW response to relevant EFW-associated accident scenarios is conservative by including single failure criteria, and that the vulnerabilities determined in the licensee's analysis, where manual EFW initiation would be necessary, are highly unlikely. Furthermore, the NRC staff performed an independent risk assessment using the ANO-1 SPAR model. The risk assessment supported the engineering conclusions that the licensee's proposed description of an operable steam path to the TD EFW pump could be used to enter Conditions A or C of TS 3.7.5 and its associated CTs of 7 days or 24 hours, respectively. Therefore, the NRC staff finds that the licensee's proposed amendment to the ANO-1 TS 3.7.5 Bases to define an operable steam flow path to

the TD EFW pump as an OPERABLE AC-powered steam supply valve (CV-2617 or CV-2667), an OPERABLE DC-powered steam supply valve (CV-2613 or CV-2663), and an OPERABLE DC-powered steam supply bypass valve (CV-2615 or CV-2665) is acceptable and meets the regulatory requirements of 10 CFR 50.36(a)(1) and the intent of NUREG-1430, Revision 4, Volume 2.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas State official was notified of the proposed issuance of the amendment on September 26, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. 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, and there has been no public comment on such finding published in the *Federal Register* on December 5, 2017 (82 FR 57473). 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.

6.0 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) there is reasonable assurance that 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: G. Purciarello

Date: October 24, 2018

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT 1 - ISSUANCE OF AMENDMENT RE:
 REVISION TO TECHNICAL SPECIFICATION BASES RELATED TO
 EMERGENCY FEEDWATER TURBINE-DRIVEN PUMP STEAM SUPPLY
 VALVES (EPID L-2017-LLA-0349) DATED OCTOBER 24, 2018

DISTRIBUTION:

- PUBLIC
- PM File Copy
- RidsACRS_MailCTR Resource
- RidsNrrDorlLpl4 Resource
- RidsNrrDssStsb Resource
- RidsNrrLAPBlechman Resource
- RidsNrrPMANO Resource
- RidsRgn4MailCenter Resource
- RidsNrrDssScpb Resource
- RidsNrrDraAphb Resource

ADAMS Accession No. ML18260A339

*by memorandum

**by e-mail

OFFICE	NRR/DORL/LPL4/PM	NRR/DORL/LPL4/LA	NRR/DSS/SCP/BC*	NRR/DRA/APHB/BC
NAME	TVengert	PBlechman	SAnderson	CFong
DATE	09/26/18	09/24/18	09/12/18	10/01/18
OFFICE	NRR/DSS/STSB/BC	OGC - NLO**	NRR/DORL/LPL4/BC	NRR/DORL/LPL4/PM
NAME	VCusumano	JWachutka	RPascarelli	TVengert
DATE	10/05/18	10/16/18	10/24/18	10/24/18

OFFICIAL RECORD COPY