



Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802
Tel 479-858-3110

Richard L. Anderson
ANO Site Vice President

10 CFR 50.90

1CAN041803

April 26, 2018

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: License Amendment Request
Revision to Technical Specification Bases related to Emergency Feedwater
Turbine-Driven Pump Steam Supply Valves
Arkansas Nuclear One, Unit 1
Docket No. 50-313
License No. DPR-51

REFERENCES

1. Entergy letter dated October 2, 2017, *License Amendment Request – Revision to Technical Specification Bases related to Emergency Feedwater Turbine-Driven Pump Steam Supply Valves* (1CAN101701) (ML17275A910)
2. NRC letter dated April 13, 2018, *Request for Additional Information Regarding License Amendment Request to Revise Technical Specification Bases 3.7.5, "Emergency Feedwater (EFW) System"* (EPID L-2017-LLA-0349) (1CNA041802) (ML18094A800)

By letter dated October 2, 2017 (Reference 1), Entergy Operations, Inc. (Entergy), requested NRC approval of a proposed change to the Arkansas Nuclear One, Unit 1 (ANO-1) Technical Specification (TS) 3.7.5, "Emergency Feedwater (EFW) System," Bases. The change would stipulate the conditions in which the TS 3.7.5, Condition A, 7-day Completion Time should apply to the ANO-1 turbine-driven EFW pump steam supply valves. The proposed amendment did not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c).

In the course of review, the NRC has determined that additional information is required with respect to the subject matter. Entergy's response to the Reference 2 request is included in the enclosure to this letter. The Entergy response does not invalidate the original no significant hazards consideration contained in the Reference 1 letter.

No new regulatory commitments are included in this amendment request.

In accordance with 10 CFR 50.91, Entergy is notifying the State of Arkansas of this amendment request by transmitting a copy of this letter and enclosure to the designated State Official.

If there are any questions or if additional information is needed, please contact Stephenie Pyle at 479-858-4704.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on April 26, 2018.

Sincerely,

ORIGINAL SIGNED BY RICHARD L. ANDERSON

RLA/dbb

Enclosure: Response to Request for Additional Information – EFW DC-Powered Steam MOVs

cc: Mr. Kriss Kennedy
Regional Administrator
U. S. Nuclear Regulatory Commission
RGN-IV
1600 East Lamar Boulevard
Arlington, TX 76011-4511

NRC Senior Resident Inspector
Arkansas Nuclear One
P. O. Box 310
London, AR 72847

U. S. Nuclear Regulatory Commission
Attn: Mr. Thomas Wengert
MS O-08B1
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Mr. Bernard R. Bevill
Arkansas Department of Health
Radiation Control Section
4815 West Markham Street
Slot #30
Little Rock, AR 72205

Enclosure to

1CAN041803

Response to Request for Additional Information

EFW DC-Powered Steam MOVs

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
EFW DC-POWERED STEAM MOVS**

By letter dated October 2, 2017 (Reference 1), Entergy Operations, Inc. (Entergy), requested NRC approval of a proposed change to the Arkansas Nuclear One, Unit 1 (ANO-1) Technical Specification (TS) 3.7.5, "Emergency Feedwater (EFW) System," Bases. The change would stipulate the conditions in which the TS 3.7.5, Condition A, 7-day Completion Time should apply to the ANO-1 turbine-driven EFW pump steam supply valves.

By letter dated April 13, 2018 (Reference 2), the NRC issued a request for additional information (RAI) with respect the Reference 1 license amendment request (LAR). The specific questions presented in the Reference 2 letter are repeated below for convenience. Entergy's response immediately follows each question.

RAI SCPB-1

Page 7 of 14 of the enclosure to the license amendment request (LAR) identifies a former ANO-1 TS Bases statement, added in 1994, that referred to the "redundant" steam supplies, as does NUREG-1430, Volume 2 "Standard Technical Specifications [STS] - Babcock and Wilcox Plants: Volume 2, Bases" (Revision 4) at B 3.7.5. However, the current version of the LCO section of ANO-1 TS Bases for B 3.7.5 states, in part:

...This requires that the turbine driven EFW pump be OPERABLE with two steam supplies (one from each of the main steam lines upstream of the MSIVs [main steam isolation valves]) and capable of supplying EFW flow to the steam generators. ...

- a. Does the omission of the word "redundant" in the TS Bases indicate a change in the operability requirements for the turbine driven EFW pump?
- b. What are the operability requirements with respect to the direct current (DC) valves in the steam supply lines for the EFW turbine driven pump to be operable?

Entergy Response

- a. With respect to TSs, especially in Modes 1 – 4, redundancy is assumed (unless otherwise stated) in two-train (or more) scenarios. No ANO-1 or NUREG-1430 Limiting Condition for Operation (LCO) includes the "redundant" term in the LCO statement, as this is considered a requirement based, in part, on the underlying 10 CFR 50, Appendix A, General Design Criteria (GDCs), on which a plant must be designed. Similarly, redundancy is required to meet single failure criterion.

The two ANO-1 steam-driven EFW pump AC-powered steam supply motor operated valves (MOVs) are required to be redundant. Because the loss of steam to the pump turbine would only involve the loss of one train of EFW (the electric-driven train would remain available), it appears unique that two steam supply paths, one from each main steam line, would be required for the steam-driven pump, as this places redundancy upon redundancy. However, because the steam-driven pump can be affected by an initiating event (such as a

main steam line break) which may require the assumption of a single failure of the electric-driven pump, it is important to design redundancy into the steam-driven EFW pump steam supply system. Therefore, a steam supply from each main steam line is required for steam-driven EFW pump operability. No other steam-path redundancy is required for the P-7A EFW subsystem.

The current Bases wording was approved by the NRC during the conversion of the ANO-1 TSs to Revision 1 of the STS in October 2001; however, no detailed discussion was included in correspondence related to the STS conversion other than to state conformance with the ANO-1 design. The difference was likely due to the existence of the ANO-1 parallel DC-powered steam supply MOV flow paths, where redundancy is not required, but included to enhance potential availability (although not necessarily operability) under certain failure modes. Note that the TS Bases parenthetical denotes that a steam supply from each of the two main steam lines (redundancy) is required. Operability requirements related to the DC-powered MOVs is discussed in Entergy's response to RAI SCPB-1, Part b, below.

- b. Entergy conservatively requires entry into the 72-hour Completion Time of TS 3.7.5, Condition B (i.e., the entire P-7A EFW train is assumed to be inoperable) when a DC-powered steam supply MOV is inoperable (depending on system configuration), due to the absence of docketed information that would permit application of Condition A (7-day Completion Time for an inoperable steam supply valve). In all cases, inoperability of the green train DC-powered steam supply MOVs requires TS entry since the P-7A EFW subsystem is the "green train" flow path to the Steam Generators (SGs). In the case where the red train DC-powered steam supply MOVs are de-energized closed such that these MOVs cannot inadvertently impact P-7A governor function (ramp circuitry), TS entry is not specifically required. With the valves de-energized closed, a red train related failure cannot affect the green train P-7A EFW function. There are other inoperable red train DC-powered steam supply MOV configurations, however, that do require TS entry.

The operability requirements for the DC-powered steam supply MOVs are similar to the operability requirements for any TS-required MOV. The MOV must automatically open within a specified time period in order for the steam-driven EFW pump to provide the required flow at sufficient pressure to the SGs by the time assumed in the accident analysis.

RAI SCPB-2

On pages 9 and 10 of the enclosure to the LAR, the licensee provides a table that identifies and assesses the various single failures for the accidents of interest, and the corresponding EFW response. The last line item on page 9 identifies a single failure of motor driven EFW Pump P-7B and states for all accidents that the EFW function is met by (turbine driven pump) P-7A via the remaining steam path. However, the NRC staff notes that for a main steam line break (MSLB) accident associated with the steam generator that would supply the remaining steam path, the remaining steam path would not be available.

Please clarify the meaning of "ALL" in the table on page 9 of 14 of the enclosure to the LAR, as it appears that the listed EFW response does not consider a MSLB on the remaining steam path.

Entergy Response

The AC-powered steam supply MOVs are normally open and contain a check valve in each flow path. In addition, the EFW steam supply is cross-connected downstream of these valves (as illustrated on Page 2 of the original LAR enclosure) such that either main steam line can experience a break without preventing steam flow from reaching the DC-powered steam supply valves. The scenarios listed in the subject table assume the AC steam supply MOVs remain open, regardless of their operability status.

To address conditions where it is assumed an inoperable AC steam supply MOV is undergoing maintenance such that it may be closed or partially closed, the subject table entry is revised to add discussion in this respect. Added text (as compared to the table included in the original LAR) is denoted by *italics*. No other line entry changes are needed for the subject table because the safety function is being maintained by the electric-driven EFW pump or the scenario would not be impacted by the position of the AC steam supply MOV that is assumed to be inoperable and out of position prior to event onset. Consistent with the original table, where function is temporarily lost, statements are bolded.

Single Failure	Accident	EFW Response
Motor-driven EFW Pump P-7B	ALL	EFW function is met by P-7A via remaining steam path, <i>assuming the inoperable AC steam supply MOV is open at the onset of the accident (valve is normally open). If the inoperable AC steam supply MOV is closed during a MSLB accident, automatic EFW function may be unavailable</i> (depending on the break location). The subject MOV would have to be manually opened (either from Control Room or locally, depending on the failure mode) to place P-7A in service.

The above adverse condition is similar to two other scenarios listed in the original table where automatic EFW function is, or may be, lost. As discussed in paragraphs following the table in the original LAR, the requested amendment does not preclude entry into a TS Action (and associated time to restore operability prior to requiring unit shutdown), but only requests that the current 7-day Completion Time applied to the AC-powered EFW steam supply MOVs also be applicable to the subject DC-powered EFW steam supply MOVs and Bypass MOVs. Because a TS Action is entered (regardless of the Completion Time), the single failures evaluated in the subject table are not applicable during postulated accident scenarios, but provided only to illustrate worse case conditions, if a single failure were to occur.

RAI SCPB-3

In the LAR, the licensee is requesting NRC approval to revise the TS Bases to state that the 7-day Completion Time of Condition A of TS 3.7.5 is applicable for inoperable DC MOVs, provided a steam supply to the turbine driven EFW pump is operable. This request is already in alignment with the NUREG 1430. However, for additional defense-in-depth analysis, the licensee provided a table with the EFW response for accidents when only one steam path is operable for the turbine driven EFW pump, concurrent with an additional single failure. The

analysis, as presented in a table in the LAR, identifies three potential single failures (“Remaining DC-powered steam MOV and/or bypass MOV” and “EFIC [Emergency Feedwater Initiation and Control] Channel A” or “Red Train DC”) where manual initiation of EFW would be needed.

Proceduralized manual actions are a means of providing defense-in-depth for component failures. Are the manual actions identified in the LAR table for the above scenarios included in existing procedures and covered in training?

Entergy Response

Appropriate procedures are entered when entry conditions are met or as needed to support plant operations, address transients, etc. Higher tier procedures (such as EOPs [Emergency Operating Procedures]) often refer the Operator to various sub-tier procedures to perform specific tasks.

The EFW pumps and valves may be manually manipulated from the Control Room on loss of EFIC channels, provided power remains available to the components. Manual control of necessary EFW system discharge valves from the Control Room is covered in Section 9.0, “Manual Intervention to Control EFW,” of procedure OP-1106.006, “Emergency Feedwater Pump Operation.”

Regarding loss of green-train DC power, Exhibit C of the aforementioned procedure provides instruction for local operation of P-7A. This exhibit does not attempt to identify all scenarios that could warrant local manual control of the pump. The exhibit first requires the trip/throttle valve on the pump turbine to be manually closed, then requires either or both of the DC-powered steam supply MOVs to be opened. The pump/turbine is then brought on line by throttling open the trip/throttle valve to obtain desired speed and discharge pressure. The exhibit also provides instructions for transferring back to the governor control system (assuming DC power is available). Otherwise, the operator maintains local control of the pump as necessary. Note the exhibit itself does not discuss operation of the AC-powered steam supply MOVs, which are assumed to be open; however, Operators will be aware of any needed system alignments based on indications of SG pressures and known configuration of inoperable equipment.

The local pump control described above differs somewhat from that described in the original LAR table which opened the DC-powered steam supply MOVs to start P-7A. Starting P-7A by opening the DC-powered steam supply MOVs is covered in EOPs, including OP-1202.012, “Repetitive Tasks,” which is referred to by several procedures.

With respect to the loss of DC power, procedure OP-1203.036, “Loss of 125V DC,” provides direction for local closure of the electric-driven pump P-7B breaker at the switchgear.

With respect to local valve manipulations, most procedures simply state to “verify” or “ensure” subject valves are in certain positions and may not dictate whether the operation is performed remotely or locally. In accordance with procedures and Operator training, such direction requires the Operator to complete the action by whatever means necessary, assuming a success path exists. Guidance includes the following with respect to *ensuring* a component is in the required position:

“To confirm that a condition exists and if it does not to take the necessary action to establish that condition.”

Based on the above, the absence of a direct action to perform a component manipulation locally does not inhibit the Operator from appropriately directing local manual operations when necessary to comply with a procedure direction.

As part of compliance with 10 CFR 50.63, "Loss of All Alternating Current Power," ANO is committed to starting and connecting its Alternate AC Diesel Generator (AACDG) within 10 minutes of a station blackout event. OP-1202.008, "Blackout," among other procedures, direct the placing of the AACDG in service. Procedure OP-2104.037, "Alternate AC Diesel Generator Operations," directs operation of the AACDG. This action can restore power to the electric-driven EFW train and AC-powered MOVs as necessary.

Because manual operator action is not being relied upon for operability and is only being addressed in the subject LAR for conditions outside the license basis (i.e., the assumption of a single failure while complying with a TS Action), a specific step or exhibit to address the potential recovery measures described in the original LAR table is not necessarily required. Nevertheless, several of these actions are specifically directed in procedures and Operators are well trained to recognize and respond to plant conditions, including the need to address individual components through local actions, if needed to fulfill a safety function. In addition, EFW is the preferred method of core heat removal and is pursued over other backup methods (such as cooling via high pressure injection). Based on the above, Entergy is confident that EFW can be established in the scenarios describe in the subject LAR table.

6.0 REFERENCES

1. Entergy letter dated October 2, 2017, *License Amendment Request – Revision to Technical Specification Bases related to Emergency Feedwater Turbine-Driven Pump Steam Supply Valves* (1CAN101701) (ML17275A910)
2. NRC letter dated April 13, 2018, *Request for Additional Information Regarding License Amendment Request to Revise Technical Specification Bases 3.7.5, "Emergency Feedwater (EFW) System"* (EPID L-2017-LLA-0349) (1CNA041802) (ML18094A800)