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

February 12, 2018

Mr. Joseph W. Shea
Vice President, Nuclear Licensing
Tennessee Valley Authority
1101 Market Street, LP 3R-C
Chattanooga, TN 37402-2801

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS RE: CORRECTING NON-CONSERVATIVE SURVEILLANCE REQUIREMENTS FOR TECHNICAL SPECIFICATION 3.8.1, "AC SOURCES – OPERATING" (CAC NOS. MF7762 AND MF7763; EPID L-2016-LLA-0044)

Dear Mr. Shea:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment Nos. 341 and 334 to Renewed Facility Operating License Nos. DPR-77 and DPR-79, for Sequoyah Nuclear Plant, Units 1 and 2, respectively. These amendments are in response to the Tennessee Valley Authority application dated May 26, 2016, as supplemented by a letter dated October 26, 2017. The amendments correct a non-conservative Technical Specification Surveillance Requirement acceptance criterion for the diesel generator steady-state frequency in Limiting Condition for Operation 3.8.1, "AC Sources – Operating."

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

Sincerely,

for

Andrew Hon, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-327 and 50-328

Enclosures:
1. Amendment No. 341 to DPR-77
2. Amendment No. 334 to DPR-79
3. Safety Evaluation

cc w/enclosures: Listserv

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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-327

SEQUOYAH NUCLEAR PLANT, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 341
Renewed License No. DPR-77

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by the Tennessee Valley Authority (the licensee), dated May 26, 2016, as supplemented by a letter dated October 26, 2017, 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, as amended; 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-77 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 341 are hereby incorporated into this renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Undine Shoop, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License and
Technical Specifications

Date of Issuance: February 12, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 341

SEQUOYAH NUCLEAR PLANT, UNIT 1

RENEWED FACILITY OPERATING LICENSE NO. DPR-77

DOCKET NO. 50-327

Replace page 3 of Renewed Facility Operating License No. DPR-77 with the attached revised page 3. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
3.8.1-6	3.8.1-6
3.8.1-7	3.8.1-7
3.8.1-8	3.8.1-8
3.8.1-10	3.8.1-10
3.8.1-11	3.8.1-11
3.8.1-13	3.8.1-13
3.8.1-15	3.8.1-15

(3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the Sequoyah and Watts Bar Unit 1 Nuclear Plants.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The Tennessee Valley Authority is authorized to operate the facility at reactor core power levels not in excess of 3455 megawatts thermal.

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 341 are hereby incorporated into this renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Initial Test Program

The Tennessee Valley Authority shall conduct the post-fuel-loading initial test program (set forth in Section 14 of Tennessee Valley Authority's Final Safety Analysis Report, as amended), without making any major modifications of this program unless modifications have been identified and have received prior NRC approval. Major modifications are defined as:

a. Elimination of any test identified in Section 14 of TVA's Final Safety Analysis Report as amended as being essential;

b. Modification of test objectives, methods, or acceptance criteria for any test identified in Section 14 of TVA's Final Safety Analysis Report as amended as being essential;

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.2	----------NOTES---------- 1. All DG starts may be preceded by an engine prelube period and followed by a warmup period prior to loading. 2. A modified DG start involving idling and gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.7 must be met. ---------- Verify each DG starts from standby conditions and achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.3	----------NOTES---------- 1. DG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one DG at a time. 4. This SR shall be preceded by and immediately follow without shutdown a successful performance of SR 3.8.1.2 or SR 3.8.1.7. ---------- Verify each DG is synchronized and loaded and operates for ≥ 60 minutes at a load ≥ 3960 kW and ≤ 4400 kW.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.4	Verify each engine-mounted "day" tank contains ≥ 250 gal of fuel oil.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.5	Check for and remove accumulated water from each engine-mounted "day" tank.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.6	Verify the fuel oil transfer system operates to transfer fuel oil from the storage system to the engine-mounted "day" tanks.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.7	----------NOTE---------- All DG starts may be preceded by an engine prelube period. ---------- Verify each DG starts from standby condition and achieves: a. In ≤ 10 seconds, voltage ≥ 6800 V and frequency ≥ 58.8 Hz and b. Steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.8	----------NOTES---------- 1. For the 1A, 1B, 1C, and 1D Unit Boards, this Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. 2. Transfer capability is only required to be met for 6.9 kV Unit Boards that require normal and alternate power supplies. ---------- Verify automatic and manual transfer of the power supply to each 6.9 kV Unit Board from the normal supply to the alternate supply.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.9	----------NOTE---------- If performed with the DG synchronized with offsite power, it shall be performed at a power factor ≤ 0.89. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. ---------- Verify each DG rejects a load greater than or equal to its associated single largest post-accident load, and: a. Following load rejection, the frequency is ≤ 66.5 Hz, b. Within 3 seconds following load rejection, the voltage is ≥ 6800 V and ≤ 7260 V, and c. Within 3 seconds following load rejection, the frequency is ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.11	----------NOTES---------- 1. All DG starts may be preceded by an engine prelube period. 2. For DGs 1A-A and 1B-B, this Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify on an actual or simulated loss of offsite power signal: a. De-energization of shutdown boards, b. Load shedding from shutdown boards, c. DG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds, 2. Energizes auto-connected shutdown loads through load sequence timers, 3. Maintains steady state voltage ≥ 6800 V and ≤ 7260 V, 4. Maintains steady state frequency ≥ 59.8 Hz and ≤ 60.2 Hz, and 5. Supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.12	----------NOTES---------- 1. All DG starts may be preceded by prelube period. 2. For DGs 1A-A and 1B-B, this Surveillance shall not normally be performed in MODE 1 or 2. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify on an actual or simulated Engineered Safety Feature (ESF) actuation signal each DG auto-starts from standby condition and: a. In ≤ 10 seconds after auto-start and during tests, achieves voltage ≥ 6800 V and frequency ≥ 58.8 Hz, b. Achieves steady state voltage ≥ 6800 V and ≤ 7260 V and frequency ≥ 59.8 Hz and ≤ 60.2 Hz, c. Operates for ≥ 5 minutes, d. Permanently connected loads remain energized from the offsite power system, and e. Emergency loads are energized from the offsite power system.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.15	----------NOTES---------- 1. This Surveillance shall be performed within 5 minutes of shutting down the DG after the DG has operated ≥ 2 hours loaded ≥ 3960 kW and ≤ 4400 kW and ≥ 2140 kvar and ≤ 2370 kvar. Momentary transients outside of load range do not invalidate this test. 2. All DG starts may be preceded by an engine prelube period. ---------- Verify each DG starts and achieves: a. In ≤ 10 seconds, voltage ≥ 6800 V and frequency ≥ 58.8 Hz and b. Steady state voltage ≥ 6800 V, and ≤ 7260 V and frequency ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.16	----------NOTE---------- For DGs 1A-A and 1B-B, this Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify each DG: a. Synchronizes with offsite power source while loaded with emergency loads upon a simulated restoration of offsite power, b. Transfers loads to offsite power source, and c. Returns to ready-to-load operation.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.18	----------NOTES---------- 1. All DG starts may be preceded by an engine prelube period. 2. For DGs 1A-A and 1B-B, this Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ESF actuation signal: a. De-energization of shutdown boards, b. Load shedding from shutdown boards, and c. DG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds, 2. Energizes auto-connected emergency loads through load sequence timers, 3. Achieves steady state voltage ≥ 6800 V and ≤ 7260 V, 4. Achieves steady state frequency ≥ 59.8 Hz and ≤ 60.2 Hz, and 5. Supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	In accordance with the Surveillance Frequency Control Program

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

TENNESSEE VALLEY AUTHORITY

DOCKET NO. 50-328

SEQUOYAH NUCLEAR PLANT, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 334
Renewed License No. DPR-79

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by the Tennessee Valley Authority (the licensee), dated May 26, 2016, as supplemented by a letter dated October 26, 2017, 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, as amended; 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-79 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 334 are hereby incorporated into this renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Undine Shoop, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License and
Technical Specifications

Date of Issuance: February 12, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 334

SEQUOYAH NUCLEAR PLANT, UNIT 2

RENEWED FACILITY OPERATING LICENSE NO. DPR-79

DOCKET NO. 50-328

Replace page 3 of Renewed Facility Operating License No. DPR-79 with the attached revised page 3. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE	INSERT
3.8.1-6	3.8.1-6
3.8.1-7	3.8.1-7
3.8.1-8	3.8.1-8
3.8.1-10	3.8.1-10
3.8.1-11	3.8.1-11
3.8.1-13	3.8.1-13
3.8.1-15	3.8.1-15

(3) Pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(4) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the Sequoyah and Watts Bar Unit 1 Nuclear Plants.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The Tennessee Valley Authority is authorized to operate the facility at reactor core power levels not in excess of 3455 megawatts thermal.

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 334 are hereby incorporated into this renewed license. The licensee shall operate the facility in accordance with the Technical Specifications.

(3) Initial Test Program

The Tennessee Valley Authority shall conduct the post-fuel-loading initial test program (set forth in Section 14 of Tennessee Valley Authority's Final Safety Analysis Report, as amended), without making any major modifications of this program unless modifications have been identified and have received prior NRC approval. Major modifications are defined as:

a. Elimination of any test identified in Section 14 of TVA's Final Safety Analysis Report as amended as being essential;

b. Modification of test objectives, methods or acceptance criteria for any test identified in Section 14 of TVA's Final Safety Analysis Report as amended as being essential;

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.2	----------NOTES---------- 1. All DG starts may be preceded by an engine prelube period and followed by a warmup period prior to loading. 2. A modified DG start involving idling and gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.7 must be met. ---------- Verify each DG starts from standby conditions and achieves steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.3	----------NOTES---------- 1. DG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one DG at a time. 4. This SR shall be preceded by and immediately follow without shutdown a successful performance of SR 3.8.1.2 or SR 3.8.1.7. ---------- Verify each DG is synchronized and loaded and operates for ≥ 60 minutes at a load ≥ 3960 kW and ≤ 4400 kW.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.4	Verify each engine-mounted "day" tank contains ≥ 250 gal of fuel oil.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.5	Check for and remove accumulated water from each engine-mounted "day" tank.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.6	Verify the fuel oil transfer system operates to transfer fuel oil from the storage system to the engine-mounted "day" tanks.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.7	----------NOTE---------- All DG starts may be preceded by an engine prelube period. ---------- Verify each DG starts from standby condition and achieves: a. In ≤ 10 seconds, voltage ≥ 6800 V and frequency ≥ 58.8 Hz and b. Steady state voltage ≥ 6800 V and ≤ 7260 V, and frequency ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.8	----------NOTES---------- 1. For the 2A, 2B, 2C, and 2D Unit Boards, this Surveillance shall not normally be performed in MODE 1 or 2. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. 2. Transfer capability is only required to be met for 6.9 kV Unit Boards that require normal and alternate power supplies. ---------- Verify automatic and manual transfer of the power supply to each 6.9 kV Unit Board from the normal supply to the alternate supply.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.9	----------NOTE---------- If performed with the DG synchronized with offsite power, it shall be performed at a power factor ≤ 0.89. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. ---------- Verify each DG rejects a load greater than or equal to its associated single largest post-accident load, and: a. Following load rejection, the frequency is ≤ 66.5 Hz, b. Within 3 seconds following load rejection, the voltage is ≥ 6800 V and ≤ 7260 V, and c. Within 3 seconds following load rejection, the frequency is ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.11	----------NOTES---------- 1. All DG starts may be preceded by an engine prelube period. 2. For DGs 2A-A and 2B-B, this Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify on an actual or simulated loss of offsite power signal: a. De-energization of shutdown boards, b. Load shedding from shutdown boards, c. DG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds, 2. Energizes auto-connected shutdown loads through load sequence timers, 3. Maintains steady state voltage ≥ 6800 V and ≤ 7260 V, 4. Maintains steady state frequency ≥ 59.8 Hz and ≤ 60.2 Hz, and 5. Supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.12	----------NOTES---------- 1. All DG starts may be preceded by prelube period. 2. For DGs 2A-A and 2B-B, this Surveillance shall not normally be performed in MODE 1 or 2. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ----------	
	Verify on an actual or simulated Engineered Safety Feature (ESF) actuation signal each DG auto-starts from standby condition and: a. In ≤ 10 seconds after auto-start and during tests, achieves voltage ≥ 6800 V and frequency ≥ 58.8 Hz, b. Achieves steady state voltage ≥ 6800 V and ≤ 7260 V and frequency ≥ 59.8 Hz and ≤ 60.2 Hz, c. Operates for ≥ 5 minutes, d. Permanently connected loads remain energized from the offsite power system, and e. Emergency loads are energized from the offsite power system.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.15	----------NOTES---------- 1. This Surveillance shall be performed within 5 minutes of shutting down the DG after the DG has operated ≥ 2 hours loaded ≥ 3960 kW and ≤ 4400 kW and ≥ 2140 kvar and ≤ 2370 kvar. Momentary transients outside of load range do not invalidate this test. 2. All DG starts may be preceded by an engine prelube period. ---------- Verify each DG starts and achieves: a. In ≤ 10 seconds, voltage ≥ 6800 V and frequency ≥ 58.8 Hz and b. Steady state voltage ≥ 6800 V, and ≤ 7260 V and frequency ≥ 59.8 Hz and ≤ 60.2 Hz.	In accordance with the Surveillance Frequency Control Program
SR 3.8.1.16	----------NOTE---------- For DGs 2A-A and 2B-B, this Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, this Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify each DG: a. Synchronizes with offsite power source while loaded with emergency loads upon a simulated restoration of offsite power, b. Transfers loads to offsite power source, and c. Returns to ready-to-load operation.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.18	----------NOTES---------- 1. All DG starts may be preceded by an engine prelube period. 2. For DGs 2A-A and 2B-B, this Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---------- Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ESF actuation signal: a. De-energization of shutdown boards, b. Load shedding from shutdown boards, and c. DG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds, 2. Energizes auto-connected emergency loads through load sequence timers, 3. Achieves steady state voltage ≥ 6800 V and ≤ 7260 V, 4. Achieves steady state frequency ≥ 59.8 Hz and ≤ 60.2 Hz, and 5. Supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	In accordance with the Surveillance Frequency Control Program

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 341 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-77, AND

AMENDMENT NO. 334 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-79

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-327 AND 50-328

1.0 INTRODUCTION

By letter dated May 26, 2016 (Reference 1), as supplemented by letter dated October 26, 2017 (Reference 2), Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request (LAR) to revise the Renewed Facility Operating Licenses for the Sequoyah Nuclear Plant (SQN), Units 1 and 2. The proposed changes would correct a non-conservative Technical Specification (TS) Surveillance Requirement (SR) acceptance criterion for the diesel generator (DG) steady-state frequency in Limiting Condition for Operation (LCO) 3.8.1, "AC Sources – Operating."

The supplemental letter dated October 26, 2017, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC or the Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on August 2, 2016 (81 FR 50740).

The NRC staff reviewed this request and, as explained below, concludes that the proposed amendments are acceptable because they are in compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36(c)(3) and General Design Criterion (GDC) 17, GDC 18, and GDC 37, and conform to Regulatory Guide (RG) 1.9, and the Institute of Electrical and Electronics Engineers (IEEE) Standard 308-1971.

2.0 REGULATORY EVALUATION

2.1 System Description

As noted in SQN Updated Final Safety Analysis Report (UFSAR) Section 8.3, "Onsite Power System," the onsite alternating current (AC) power system is a Class 1E system, which consists of the standby AC power system and the 120 Volt (V) vital AC system. The standby AC power

system is a safety-related system, which supplies power for energizing all AC-powered electrical devices essential to safety. The safety function of the standby AC power system is to supply power to permit functioning of components and systems required to assure that: (1) fuel design limits and reactor coolant pressure boundary design conditions are not exceeded due to anticipated operational occurrences, and (2) the core is cooled and vital functions are maintained in the event of postulated accidents, subject to loss of the preferred power system and subject to any single failure in the standby power system.

Specifically, the standby AC power system includes:

- four Class 1E DGs (designated 1A-A, 1B-B, 2A-A, and 2B-B)
- four 6.9 kilovolt (kV) shutdown boards and logic relay panels
- associated 6.9 kV/480 V transformers and 480 V shutdown boards
- motor control centers supplied by the 480 V shutdown boards

The AC standby power system is divided into two redundant load groups (power trains). The 6.9 kV shutdown boards are arranged electrically into two power trains with two boards associated with each train and each unit. The boards comprising train A are located in the SQN Unit 1 side and those of train B are located in the SQN Unit 2 side. The train A boards are separated from the train B boards by a reinforced concrete block wall, which is a qualified fire barrier, extended to the ceiling. When the preferred (offsite) power system is not available, each shutdown board is energized from a separate standby DG.

Each DG consists of two 16-cylinder engines directly connected to a 6.9 kV generator. The continuous rating of each DG is 4400 kilowatt (kW) at 0.8 power factor, 6.9 kV, 3-phase, and 60 hertz (Hz). Each DG also has an additional rating of 4840 kW for 2 hours out of 24 hours. The four SQN DGs are shared between SQN Units 1 and 2, and the SRs for all four DGs are specified in the SQN Units 1 and 2 TSs.

The SQN Units 1 and 2 DG voltage regulators and speed regulators are independent devices that are not expected to exhibit drift. TVA stated in the LAR that it evaluated the combined impact; if the two variables drift in different directions (e.g., frequency lower and voltage higher), the combined effect on pump speed would be less than an individual drift.

2.2 Proposed Changes

Currently, the acceptance criterion for the DG steady-state frequency range is greater than or equal to (≥) 58.8 Hz and less than or equal to (≤) 61.2 Hz. TVA proposed to change the DG steady-state frequency acceptance criterion range to ≥ 59.8 Hz and ≤ 60.2 Hz for SRs 3.8.1.2, 3.8.1.7, 3.8.1.9, 3.8.1.11, 3.8.1.12, 3.8.1.15, and 3.8.1.18. In addition, the proposed change affects SR 3.8.1.3, because that SR requires successful performance of SR 3.8.1.2 or 3.8.1.7. LCO 3.8.2, "AC Sources – Shutdown," is also affected because SR 3.8.2.1 requires all of the applicable SRs of TS 3.8.1 to be performed. There are no direct changes to SRs 3.8.1.3 or 3.8.2.1. TVA stated in its LAR that the DG steady-state voltage SR criterion range (≥ 6800 V and ≤ 7260 V) is unaffected and did not propose a change to it.

2.3 Regulatory Requirements

The following regulations are applicable to the NRC staff's review of this LAR:

Section 50.36 of 10 CFR, "Technical specifications," requires, in part, that TSs include LCOs and SRs. LCOs are the lowest functional capability or performance levels of equipment required for safe operation of the facility. SRs are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the LCOs will be met.

GDC 17, "Electric power systems," of 10 CFR Part 50, Appendix A, requires, in part, that nuclear power plants have an onsite and an offsite electric power system to permit the functioning of structures, systems, and components that are important to safety.

GDC 18, "Inspection and testing of electric power systems," requires, in part, that electric power systems important to safety be designed to permit appropriate periodic inspection and testing of important areas and features, such as wiring, insulation, connections, and switchboards, to assess the continuity of the systems and the condition of their components.

GDC 37, "Testing of emergency core cooling system [ECCS]," requires that the ECCS be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leak tight integrity of its components, (2) the operability and performance of the active components of the system, and (3) the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation, including operation of applicable portions of the protection system, the transfer between normal and emergency power sources, and the operation of the associated cooling water system.

The NRC staff also considered the following documents:

Regulatory Guide 1.9, Revision 0, "Selection of Diesel Generator Set Capacity for Standby Power Supplies."

Regulatory Guide 1.9, Revision 1, "Selection, Design, and Qualification of Diesel-Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants."

The IEEE Standard 308-1971, "Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations."

3.0 TECHNICAL EVALUATION

Plant safety analyses evaluate flow rate requirements for motor-driven loads based on motors operating at a nominal frequency of 60 Hz. In the event of loss of offsite power (LOOP), the onsite DGs are required to support safe shutdown of the plant and mitigate the consequences of an accident. However, the DGs may not be able to operate at exactly 60 Hz due to inherent limitations of control systems.

In the LAR, TVA proposed a more conservative steady-state frequency range, $\geq$ 59.8 Hz to $\leq$ 60.2 Hz, for the DGs at SQN Units 1 and 2. The DG frequency variation has the direct effect of changing motor speed for the motors powered from the DGs following an LOOP event, or loss of coolant accident coincident with an LOOP. Typical affected loads and attributes that are considered in the LAR include:

1. Pump flow rate and head
2. Fan flow rate

3. Air compressor and chiller flow rate
4. Motor-operated valves (MOVs) stroke time
5. Electrical equipment – capacity and capability

In the LAR Section 3.2.1, the licensee stated that "Calculations were conducted to determine the effects of the DG frequency variation between 59.8 Hz and 60.2 Hz on plant equipment fed by the DGs following a loss of offsite power (LOOP) or a loss of coolant accident (LOCA) coincident with a LOOP." Based on this information, the NRC staff concludes that TVA has evaluated all of the automatically and manually connected loads on the DGs for frequency variations. SQN UFSAR Table 8.3.1-2 provides a list of loads that are automatically connected to the DGs and includes accident and non-accident loads (in kW and kilovolt-amperes (kVA)) as follows:

EQUIPMENT NAME	TIME (Seconds)	STARTING KVA (or kW)	NON ACCIDENT	ACCIDENT
480V Shutdown Loads (3)	0	5132	Yes	Yes
Centrifugal Charging Pump	2	3601	Yes	Yes
Safety Injection Pump	5	2458	No	Yes
Residual Heat Removal Pump	10	2401	No	Yes
Essential Raw Cooling Water Pump	15	3852	Yes	Yes
Aux. [Auxiliary] Feedwater Pump	20	3201	Yes	Yes
Component Cooling System Pump**	30	3541	Yes	Yes
Pzr. [Pressurizer] Heaters Backup Group	90	485 kW	Yes	No
Containment Spray Pump***	180	4058	No	Yes
Control Room Air Handling Unit****	220	336	N/A	Yes
Electric Board Room Air Handling Unit****	240	420	N/A	Yes

Footnotes:
** Diesel generator 1A or 2B will have two component cooling system pumps loaded
*** Only sequential loaded following a Containment Spray Actuation Signal.
**** Only stripped for a Phase B [SI]

The following is a summary of TVA's technical justification and the NRC staff's review.

Impact of Voltage and Frequency

In Section 3.2.2 of the LAR, the licensee referenced an equation from Westinghouse Topical Report WCAP-17308, "Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances." The NRC staff questioned the use of WCAP-17308 in Request for Additional Information 1 (RAI-1), because at the time of the staff's RAI (issued on April 20, 2017), WCAP-17308 was not approved by the NRC for licensees to incorporate it into applications by reference. The licensee stated in its response dated October 26, 2017, that the equation in the LAR was not used to evaluate the effect of frequency variations. The licensee added, "The equation from WCAP-17308 on page E8 was provided to show how changes in frequency and voltage can affect motor speed." The licensee provided a revised Section 3.2.2, which superseded the original LAR's corresponding section.

The licensee described in the revised Section 3.2.2 how the impact of variations in voltage and frequency on the affected components was evaluated. Frequencies above or below nominal (60 Hz) affect motor speed by increasing or decreasing it, respectively. Subsequently, the motor's

horsepower requirements increase or decrease by the cube of the speed change. Therefore, increased motor speed would cause increased horsepower demands on a DG. The licensee concluded that:

> Consequently, an under-frequency would not negatively impact diesel generator loading calculations. Not all loads are affected by frequency increase (e.g., battery chargers and transformers); however, it is conservative to assume that they are affected.

The licensee further stated that:

> DG steady state voltage can vary from 6800V to 7260V. Voltage variations affect reactive power for motor and static loads, and real power for static loads. By applying the upper bound of voltage (7260V) allowed to the maximum loads calculated for the DG, an additional load can be calculated for the potential variation in voltage allowed.

Effect on Pumps

Section 3.2.3 of the LAR evaluates the effect of frequency variation of pump net positive suction head (NPSH) and pump test points. The licensee stated that the pumps that could be affected by frequency variation are the containment spray (CS) pumps, safety injection (SI) pumps, residual heat removal (RHR) pumps, and centrifugal charging (CC) pumps.

The licensee performed an evaluation to determine if the NPSH available (NPSHA) exceeds the NPSH required (NPSHR) for the RHR and CS pumps when they take suction from the containment sump in the recirculation mode. The NPSH margin was also determined for the CS, SI, RHR, and CC pumps during injection mode operation with suction taken from the refueling water storage tank (RWST). The licensee only presented the injection mode results in the LAR, because that mode has less NPSH margin than the recirculation mode. This is acceptable to the NRC staff, because it is the more conservative mode of operation for pump NPSH.

Section 3.2.3.1 of the LAR states that the ratio of pump flows, at nominal emergency DG (EDG) frequency and the frequency variation, is equal to the ratio of the EDG nominal frequency and the EDG nominal frequency plus or minus (±) the frequency variation. The NRC staff finds this statement acceptable because it is based on the pump affinity laws. Based on this ratio, the licensee concluded that a ± 0.2 Hz change in EDG frequency will change the pump flow by ± 0.33 percent, which would have a negligible effect on plant operation. The licensee stated that the American Society of Mechanical Engineers OM Code inservice pump testing acceptance criteria upper limit will be adjusted downward, and the lower limit will be adjusted upward in order to accommodate the change in flow due to the EDG frequency variation. The NRC staff finds this conclusion acceptable.

Section 3.2.3.1.2 of the LAR states that the NPSHR for pumps increases as the pump speed and flowrate increase. It is stated that the NPSHR is also affected by the increase in EDG frequency as follows:

$$NPSHR_2 = \frac{(N_2\sqrt{Q_2})^{4/3}}{(N_1\sqrt{Q_1})^{4/3}} * NPSHR_1$$

where,

Q_2 = Changed pump flow due to DG frequency variation
Q_1 = Nominal pump flow
N_2 = Changed pump speed due to DG frequency variation
N_1 = Nominal pump speed

The NRC staff finds this equation acceptable, because it is a derivation of the pump affinity laws.

The LAR contained Table 3 titled, "NPSH Margin While Operating in RWST Injection Mode with Revised DG Frequency." In the table, NPSHA is calculated for the pumps during injection mode with the EDG frequency at 60.2 Hz. The NPSHR values in the table were obtained from the pump manufacturer's NPSH curves at the flow values listed in the table. The table provides the NPSH margin for each pump as shown below:

System	CS		CC		SI		RHR	
Pump Number	A-A	B-B	A-A	B-B	A-A	B-B	A-A	B-B
NPSHA (ft)	39.7	25.1	46.5	46.7	35.3	34.6	27.2	21.8
NPSHR (ft)	12.1	12.1	18	18	19	19	15	15
NPSH margin (ft)	27.6	13	28.5	28.7	16.3	15.6	12.2	6.8

The data show that at an EDG frequency of 60.2 Hz, there is sufficient NPSH margin so that the pumps will not cavitate. Thus, it is acceptable to the NRC staff.

Effect on Motor-Operated Valves (MOVs)

Section 3.2.5 of the LAR evaluates the effect of frequency and voltage related to EDG loading on MOVs. The licensee used a standard equation to show that for an EDG frequency variance of ± 0.2 Hz, the valve stroke times will vary by ± 0.33 percent. The licensee stated that the stroke time of 120 seconds for the valves involved in the automatic containment sump swap over would vary by approximately ± 0.4 seconds.

The NRC staff finds the standard equation used by the licensee for the effect of EDG frequency variance on valve stroke time to be acceptable. For a valve stroke time of 120 seconds, the variance of ± 0.4 seconds is within the margin of error, because the valve stroke time is typically measured with a stopwatch by a plant operator.

In response to a staff RAI, the licensee provided the impact of pump discharge pressure/differential pressure on MOVs. The licensee stated that the pump affinity laws can be applied using the following formula to determine pressure changes due to an increase in EDG frequency:

$H_2 = H_1 / (N_1/N_2)^2$

where

H_2 = Changed pump pressure due to EDG frequency variation
H_1 = Nominal pump pressure
N_2 = Changed pump speed due to EDG frequency variation
N_1 = Nominal pump speed

Using the above equation, the licensee stated that the increase in total pump pressure due to increasing the EDG frequency to 60.2 Hz is 0.7 percent. The licensee evaluated all active safety-related MOVs to determine if a 0.7 percent increase in pump discharge pressure would affect the ability of each MOV to perform its design function. The differential pressure for the MOVs was determined based on the system's pump shutoff head or the expected pump discharge pressure at nominal flow. The licensee determined that the 0.7 percent change in pressure during an EDG over frequency condition is minimal and non-significant in comparison to the conservative approach taken to develop the MOV differential pressures and the development of the MOV calculations. The licensee concluded that all MOVs will perform their design function and the minimal MOV differential pressure increase due to EDG over frequency will not affect the results of the calculations nor the setup of the MOVs in the plant. The NRC staff finds that a 0.7 percent increase in pump discharge pressure is not significant and will not prevent the MOVs from performing their design function.

Effect on Fans, Air Compressors, and Chillers

Changes in DG frequency can directly increase or reduce motor speeds for fans. Additionally, increased or reduced fan motor speeds are directly proportional to fan flows. TVA evaluated the impact of the DG frequency range of 59.8 Hz to 60.2 Hz and determined that fan flow could vary ± 0.33 percent from nominal. TVA referenced in its LAR an internal document (G-Spec G-37 R5, "Testing and Balancing of HVAC [Heating, Ventilation, and Air Conditioning] Systems during Installation, Modification, and Maintenance") that is used to balance airflow in the plant areas. TVA stated that, according to the G-Spec document, the total airflow of a system can vary by ± 10 percent at the system fan and the ± 0.33 percent change due to DG frequency variations is well within the allowable tolerances for airflow requirements.

TVA also evaluated the impact of frequency variation on air compressor and chiller flows. TVA determined that a ± 0.33 percent change in DG frequency has a negligible effect on intermittently-operated equipment such as the compressors and chillers. The NRC staff considers the capacity and capability of the fans, compressors, and chillers to perform their expected safety functions during postulated events as the acceptance criteria for the evaluation. The duration of the required functions, intermittent, short term, or extended operation only impacts the DG loading evaluation. Based on TVA's statement that the change in flow rates for fans, air compressors, and chillers is within the acceptance criteria, the NRC staff concludes that the fans, compressors, and chillers will perform their intended functions at the proposed allowable frequency range.

Effect on Electrical Equipment

TVA evaluated only electronically controlled static loads from equipment such as battery chargers, inverters, and uninterruptible power supplies for potential frequency variation effects. This is because static loads are generally insensitive to changes in frequency, with the exception of electronically controlled static loads. TVA also evaluated the impact of frequency variation on electrical equipment such as hydrogen igniters and instrumentation.

In the case of the battery chargers, the 125 V direct current output voltage is regulated at ± 1 percent with an AC input voltage of +10 percent / -15 percent and frequency of ± 5 percent. The proposed DG frequency range of ≥ 59.8 and ≤ 60.2 Hz is bounded by the operational tolerance of the battery chargers. Therefore, TVA determined that the frequency variation will not affect battery charger performance.

The hydrogen igniters are supplied by a regulated transformer which maintains its output voltage at ± 1 percent. The regulated transformer can operate with variances of ± 10 percent for voltage and ± 5 percent for frequency. TVA concluded that there is no adverse impact on the performance capabilities of hydrogen igniters due to minor voltage and frequency variations.

The 120 V AC instrumentation circuits are designed to operate with a ± 1 percent frequency variation. Since the effect of the proposed DG frequency is within this range (± 0.2 Hz from nominal is a 0.33 percent variation), TVA determined that this equipment will not be affected.

The LAR does not discuss all the loads that are impacted by voltage variations such as heaters associated with equipment. These include pressurizer heaters and loads such as air-handling units, charcoal filters, and hydrogen recombiners. However, in Section 3.2.6 of the LAR, the licensee stated "The maximum allowable board voltage is 7260 V and the degraded voltage relay safety limit dropout setting is 6400 V. The variation in voltage from the DG of 6800 to 7260 V is much less than the range expected from the offsite source. Therefore, the variation in DG output voltage is bounded by voltage variations when off site power supplies the AC auxiliary power system." Based on the statement provided by TVA, the NRC staff concludes that the licensee has evaluated the performance capabilities of electrical equipment to operate satisfactorily and within the parameters credited in accident analysis at 6400 V and considers this as the bounding low voltage for equipment operability to satisfy current licensing basis. The staff therefore finds that the 6800 V lower limit for the DGs remains sufficient.

The NRC staff concludes that TVA's evaluation summarized in the LAR is acceptable and that the affected electrical equipment will continue to perform within the design specifications.

Effect on Horsepower Requirements for DGs

Horsepower requirements for motors increase by the cube of the speed change. Consequently, increased motor speed increases the horsepower demands on the DG supplying the subject load. TVA evaluated the effect on the loads due to DG operation at the upper limit frequency and voltage, 60.2 Hz and 7260 V, respectively. In its response to RAI-2, TVA stated, "The results of operating at the upper end of the current technical specification (TS) voltage range are bounded by the results of operating at the upper end of the frequency variations." The highest steady-state loading was used as a bounding condition.

The licensee stated in its response to RAI-2 that Section 3.2.3.4 of the LAR was revised and superseded. In revised Section 3.2.3.4, TVA stated that its calculations showed that an SQN DG operating at a frequency of 60.2 Hz would cause a 0.33 percent increase in motor speed. TVA cubed the change in motor speed to determine the horsepower requirements, which resulted in a calculated SQN DG kW load increase of 1 percent. TVA did not specify in its LAR the SQN DG load values with respect to the DG rated capacity.

The NRC staff notes that the SQN DGs have a continuous rating of 4400 kW at 0.8 power factor and an additional short term rating of 4840 kW for 2 hours out of 24 hours. The duration of maximum postulated steady state loading typically depends on the size and type of postulated

events or accidents. The short term rating provides margin for transient conditions such as large motor starting and the potential for pumps operating at runout conditions at the onset of an event.

In RAI-2, the NRC staff requested additional information regarding the DG loading values at nominal and upper end steady-state ranges for voltage (7260 V) and the proposed frequency (60.2 Hz). Additionally, the staff requested that the licensee provide a discussion of effects on motor as well as non-motor loads, since it was not clear in the LAR that non-motor loads were considered.

In its response, the licensee stated that while the effect of frequency variation on non-motor loads was insignificant, the 1 percent kW load increase was conservatively applied to all loads. The load calculation summaries for nominal and upper bound frequencies were addressed in the responses to RAI-2c and RAI-2e, respectively. The licensee confirmed that the DG load values at nominal frequency and voltage assumed the worst case mechanical loading, bounding runout conditions. The licensee provided tables of nominal voltage and frequency for SQN DG load values with maximum postulated, worst case loading. The licensee evaluated DG loading for these plant conditions: an LOOP, an LOOP with Phase A safety injection (SI), and an LOOP with Phase B SI. TVA's tabulated response provided information on DG loading during the sequencing process and operation for the first 2 hours and also steady-state operation beyond 2 hours. The tables represent the total steady-state running load of all sequenced loads plus the base continuous load on each DG plus random loads. The licensee stated that the plant condition with the highest load for the DGs is an LOOP concurrent with Phase B SI (LOOP+SIB). Of the four DGs, 2B-B presented the highest load values relative to the DG rating (i.e., the least minimum margin). Tables 1 and 2 below summarize the SQN DG 2B-B load values.

TABLE 1: Maximum Steady-State Running Load, 0 hours to 2 hours

DG Loading at Nominal Voltage and Frequency (LOOP+SIB)			
Parameter	DG 2B-B Load	Short Time Rating	Minimum Margin (%)
kW	4344.83 >720 sec	4840	10.2
kVA	4863.29 >720 sec	5500	11.6

TABLE 2: Maximum Steady-State Running Load, 2 hours to End

DG Loading at Nominal Voltage and Frequency (LOOP+SIB)			
Parameter	DG 2B-B Load	Continuous Rating	Minimum Margin (%)
kW	4154.04	4400	5.6
kVA	4644.92	5000	7.1

The licensee provided the kW and kVA load summary tables prefaced with the fact that DG 2B-B under LOOP with SIB condition, operating at 60.2 Hz and 7260 V (the upper range frequency and voltage) "envelops the other steady state loading scenarios and bounds operating at the

upper end of the current TS voltage range." The licensee stated that the SQN DG capacity margin provided in the response to RAI-2d "bounds operating at the upper end of the proposed frequency range and the upper end of the current TS voltage range." The licensee stated that the DG margins at the upper bounds for steady-state loads, running from 2 hours to end, are 4.64 percent for total kW and 6.0 percent for total kVA.

The NRC staff reviewed the DG horsepower information provided in TVA's LAR and supplemental letter. The NRC staff concludes that the DG load calculations demonstrate that there is sufficient loading margin during steady state operations for the proposed frequency range.

Effect on DG Fuel Oil Storage Requirements

The DG Fuel Oil System consists of four embedded storage tank assemblies, one for each DG unit, and associated pumps, valves, and piping. The tanks are embedded in the DG Building substructure with a capacity of approximately 68,000 gallons of fuel for each DG unit. The change in DG loading impacts the volume of fuel oil stored on site. The licensee stated that the volume of fuel oil stored is calculated based on a fully loaded DG. The staff concluded that the 7-day onsite storage requirement, based on operation of DGs at nominal rating of 5500 kVA for 7 days, is conservative. Therefore, the impact of DG voltage and frequency variations will not adversely affect onsite fuel oil storage requirements.

The NRC staff reviewed the summary of the evaluation related to the allowable frequency and voltage bands for the SQN DGs. The NRC staff concludes that TVA's analysis is acceptable, as the DGs will continue to operate within the nameplate capability. Additionally, the change in speed of pumps and motors due to the proposed frequency variations and current voltage variations will not adversely impact the capability of SQN equipment required for safe shutdown of the dual units.

Technical Review Summary

TVA evaluated both the DG voltage and frequency operating ranges for performance adequacy and determined that while the existing voltage range was sufficient, the frequency range was found to be non-conservative and requested SR acceptance criteria changes to restore the conservatism. The NRC staff reviewed TVA's technical justification provided in the LAR and supplemental letter (References 1 and 2). Based on the information provided by the licensee, the NRC staff concludes that TVA adequately evaluated the changes in equipment performance due to the proposed change in the allowable operating frequency for the DGs.

The proposed amendments would revise the acceptance criterion for the DG steady-state frequency provided in SRs 3.8.1.2, 3.8.1.7, 3.8.1.9, 3.8.1.11, 3.8.1.12, 3.8.1.15, and 3.8.1.18. The NRC staff finds the proposed amendments acceptable because they are in compliance with 10 CFR 50.36(c)(3) and GDC 17, GDC 18, and GDC 37, and conform to RG 1.9, and IEEE Standard 308-1971 as follows.

The proposed amendments meet the requirements of 10 CFR 50.36(c)(3) because the more conservative SR test acceptance criterion for DG steady-state frequency (59.8 Hz to 60.2 Hz) provides reasonable assurance that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that LCO 3.8.1 will be met.

The proposed amendments satisfy GDC 17 because the more conservative DG steady-state frequency range provides reasonable assurance that the DGs have the capability to support the functioning of structures, systems, and components important to safety.

The proposed amendments continue to satisfy GDC 18 because there is no change in the methodology of testing and inspection, and they would not impact the inspection and testing of electric power systems important to safety.

The proposed amendments continue to satisfy GDC 37, because there is no change in the methodology of testing and inspection, and they would not impact the periodic pressure and functional testing for the ECCS.

The licensee stated in the LAR that the maximum postulated DG loading, with the DG operating at the maximum allowable voltage and frequency range, is less than the nominal DG rating of 4400 kW. Therefore, the DGs at SQN Units 1 and 2 continue to conform to RG 1.9, Revision 0.

The proposed amendments conform to design criterion 4.3, "Power Quality," in IEEE Standard 308-1971 because the proposed DG frequency range provides reasonable assurance that frequency variations in the Class 1E electric power systems will not degrade the performance of any load during any design-basis event that may damage the fuel or reactor coolant system.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Tennessee State official was notified of the proposed issuance of the amendments on February 07, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20 and change SRs. The NRC staff has determined that the amendments involve 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 amendments involve no significant hazards consideration, and there has been no public comment on such finding published in the *Federal Register* on August 2, 2016 (81 FR 50740). Accordingly, the amendments meet 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 amendments.

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 the 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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. TVA letter to NRC, "Application to Modify Sequoyah Nuclear Plant, Units 1 and 2 Technical Specifications Regarding Diesel Generator Steady State Frequency (SQN-TS-14-02)," dated May 26, 2016 (ADAMS Accession No. ML16148A175).

2. TVA letter to NRC, "Response to Request for Additional Information (RAI) regarding Application to Modify Sequoyah Nuclear Plant, Units 1 and 2 Technical Specifications Regarding Diesel Generator Steady State Frequency (SQN-TS-14-02) (CAC Nos. MF7762 and MF7763)," dated October 26, 2017 (ADAMS Accession No. ML17299A810).

3. Regulatory Guide 1.9, Revision 0, "Selection of Diesel Generator Set Capacity for Standby Power Supplies," dated March 10, 1971 (ADAMS Accession No. ML012410194).

4. Regulatory Guide 1.9, Revision 1, "Selection, Design, and Qualification of Diesel-Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," dated November 1978 (ADAMS Accession No. ML13226A211).

5. The Institute of Electrical and Electronics Engineers Standard 308-1971, "Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations."

6. Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," dated June 28, 1989 and "Supplement 1 to Generic Letter 89-10: Results of the Public Workshops," dated June 13, 1990.

Principal Contributors: K. N. West
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Date: February 12, 2018

SUBJECT: SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - ISSUANCE OF AMENDMENTS RE: CORRECTING NON-CONSERVATIVE SURVEILLANCE REQUIREMENTS FOR TECHNICAL SPECIFICATION 3.8.1, "AC SOURCES – OPERATING" (CAC NOS. MF7762 AND MF7763; EPID L-2016-LLA-0044) DATED FEBRUARY 12, 2018

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