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10 CFR 50.90

December 15, 2021

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Limerick Generating Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

SUBJECT: License Amendment Request
Proposed Changes to Technical Specification Surveillance Requirements for Emergency Diesel Generator Frequency and Voltage Tolerances and for Emergency Core Cooling System Pump Flows (Implementing WCAP-17308)

Reference: 1. WCAP-17308-NP-A, Revision 0, “Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances,” dated July 2017 (ML17215A232)

Pursuant to 10 CFR 50.90, “Application for amendment of license, construction permit, or early site permit,” Exelon Generation Company, LLC (Exelon), proposes changes to the Technical Specifications (TS), Appendix A of Operating License Nos. NPF-39 and NPF-85 for Limerick Generating Station (LGS), Units 1 and 2, respectively. The proposed amendments would revise certain frequency and voltage acceptance criteria for steady-state emergency diesel generator (EDG) surveillance requirements under TS 3/4.8.1, "A.C. Sources - Operating." The proposed changes are consistent with WCAP-17308-NP-A (Reference 1). In addition, the proposed amendments would revise the flow acceptance criteria of the emergency core cooling system pump surveillance requirements under TS 3/4.5.1, “ECCS-Operating.”

The license amendment request (LAR) is required to correct a non-conservative TS. Plant operations are currently administratively controlled as described in Regulatory Guide 1.239, “Licensee Actions to Address Nonconservative Technical Specifications,” which endorses NEI 15-03 Revision 3, “Licensee Actions to Address Nonconservative Technical Specifications.” In accordance with the guidance in NEI 15-03, this LAR is required to resolve a non-conservative TS and is not a voluntary request to change the LGS licensing basis.

Attachment 1 provides the evaluation of the proposed changes. Attachment 2 provides the existing TS pages marked up to show the proposed changes. Attachment 3 provides the existing TS Bases pages marked up to show the proposed changes (for information only). Attachment 4 provides the Safeguard 4.16 KV and 480V Distribution Simplified Diagram. Attachment 5 provides Safety Related Pump Data. Attachment 6 provides the Safety Related Fan/Blower/Compressor Data. Attachment 7 provides the list of Safety Related Motor

Operated Valves (MOVs) Analyzed. Attachment 8 provides the LGS 480V Distribution System Simplified Diagram.

The proposed changes have been reviewed by the LGS Plant Operations Review Committee in accordance with the requirements of the Exelon Quality Assurance Program.

There are no regulatory commitments contained within this submittal.

Exelon has concluded that the proposed changes present no significant hazards consideration under the standards set forth in 10 CFR 50.92, Issuance of amendment."

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), Exelon is notifying the Commonwealth of Pennsylvania of this application for license amendments by transmitting a copy of this letter and its attachments to the designated State Official.

Exelon requests approval of the proposed amendments by December 15, 2022. Upon NRC approval, the amendments shall be implemented within 120 days of issuance.

If you have any questions or require additional information, please contact Frank Mascitelli at 610-765-5512.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15th day of December 2021.

Respectfully,

D. P. Helker

David P. Helker
Sr. Manager, Licensing
Exelon Generation Company, LLC

Attachments:
1. Evaluation of Proposed Changes
2. Markup of Proposed Technical Specifications Pages
3. Markup of Proposed Technical Specification Bases Pages (for information only)
4. Safeguard 4.16 KV and 480V Distribution Simplified Diagram
5. Safety Related Pump Data
6. Safety Related Fan/Blower/Compressor Data
7. Safety Related MOVs Analyzed
8. LGS 480V Distribution System Simplified Diagram (fix alignment 1-8)

cc:
USNRC Region I, Regional Administrator — w/ attachments
USNRC Project Manager, LGS — "
USNRC Senior Resident Inspector, LGS — "
Director, Bureau of Radiation Protection - Pennsylvania Department of Environmental Protection — "

## ATTACHMENT 1

**License Amendment Request**
**Limerick Generating Station, Units 1 and 2**

**Docket Nos. 50-352 and 50-353**

## EVALUATION OF PROPOSED CHANGES

**Subject:** **License Amendment Request**
**Proposed Changes to Technical Specification Surveillance Requirements for Emergency Diesel Generator Frequency and Voltage Tolerances and for Emergency Core Cooling System Pump Flows (Implementing WCAP-17308)**


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## 1.0 SUMMARY DESCRIPTION

Pursuant to 10 CFR 50.90, "Application for amendment of license or construction permit," Exelon Generation Company, LLC (Exelon), proposes changes to the Technical Specifications (TS), Appendix A of Renewed Facility Operating License Nos. NPF-39 and NPF-85 for Limerick Generating Station (LGS), Units 1 and 2, respectively.

A concern was raised during a Component Design Bases Inspection (CDBI) associated with allowable Technical Specifications (TS) range of voltage and frequency for Emergency Diesel Generators (EDGs). Specifically, current analysis of LGS does not include the effects of operation of the EDGs over the allowable TS range of voltage and frequency. A new Exelon design analysis, LM-0736, "Analyses of Emergency Diesel Generator Technical Specification Voltage and Frequency Range and Tolerances," (Reference 1) was performed to evaluate the impacts of frequency and voltage variations on the EDG loading calculations, EDG fuel oil consumption calculations, Emergency Core Cooling System (ECCS) performance, motor-operated valve (MOV) performance, and Heating Ventilation and Air Conditioning (HVAC) fan/blower performance, consistent with WCAP-17308-NP-A, Rev 0, issued July 2017 (Reference 2). This formal design analysis includes the eight LGS EDGs: Unit 1 - D11, D12, D13, D14; Unit 2 - D21, D22, D23, and D24.

The analysis performed per LM-0736 revealed that a TS change is needed to maintain operating margin for Emergency Core Cooling (ECCS) pumps and to correct a non-conservative TS. This License Amendment Request (LAR) will change the EDG steady-state operating frequency band from 60 Hz ± 1.2 Hz to 59.8-60.8 Hz for eight Surveillance Requirements (SRs). Note that the steady-state TS voltage tolerance expressed as "4280 ± 120 volts" is proposed to change to "≥ 4160 V and ≤ 4400 V" for greater clarification and alignment to improved Standard Technical Specification (ITS) format. The actual voltage tolerance is not changed. The functions of the EDG are not changed as a result of this modification. The LAR is changing the steady-state operating frequency of the EDGs to a more realistic value, is more conservative and resolves a non-conservative TS.

In addition, to address the non-conservative TS and to gain additional operating margin at the proposed EDG frequency and voltage steady state frequency tolerances, the ECCS core spray system (CSS) and Low Pressure Coolant Injection (LPCI) Pumps will have their TS SR flow acceptance criteria revised from 3,175 and 10,000 gpm to 2,500 and 8,000 gpm, respectively.

Also, this LAR will include correcting two typographical errors. For Unit 1, TS 3.8.3.1.a.8.b, the 480-VAC load center labeled "D224" is a typographical error and should be labeled as "D244." The second typographical error is in Unit 1 TS 4.8.1.1.2.e.2. An erroneous "c)" had been inserted into the middle of the TS 4.8.1.1.2.e.2.b wording; the "c)" will be deleted.

The license amendment request (LAR) is required to correct a non-conservative TS. Plant operations are currently administratively controlled as described in Regulatory Guide 1.239, "Licensee Actions to Address Nonconservative Technical Specifications." which endorses NEI 15-03, "Licensee Actions to Address Nonconservative Technical Specifications." In accordance with the guidance in NEI 15-03, this LAR is required to resolve a non-conservative TS and is not a voluntary request to change the LGS licensing basis.

Evaluation of the proposed changes are provided in Attachment 1. Markups of the proposed TS changes are provided in Attachment 2. Markups of proposed TS Bases (for information only) are provided in Attachment 3.

## 2.0 DETAILED DESCRIPTION

### 2.1 Background

The onsite ac electric power system consists of Class 1E and non-Class 1E power systems. The two offsite power systems provide the preferred ac electric power to all Class 1E loads. One source is the 220-13 kV startup transformer in the 220 kV substation. The second source is from a 13 kV tertiary winding of the 220-500 kV bus tie autotransformer in the 500 kV substation. In the event of total Loss-of-Offsite Power (LOOP), eight onsite independent EDGs (four diesel generators per unit) provide the standby power for all engineered safeguard loads.

Each unit is provided with separate and independent onsite Class 1E ac power systems. The Class 1E power system for each unit consists of four independent Class 1E buses, powered by four independent EDGs, which provide power to four divisions of Class 1E loads. See Attachment 4, Safeguard 4.16 KV and 480V Distribution Simplified Diagram for Unit 1 as an example of Class 1E Loads powered by the EDGs.

The standby power supply for each division consists of one EDG set complete with accessories and fuel storage and transfer systems. Each EDG is connected to only one 4 kV Class 1E bus and is interlocked to prevent parallel operation during a LOOP. The four Class 1E buses for each reactor unit are operated as separate buses (split bus system) and are not synchronized. Each EDG set is operated independently (from the other sets) and is disconnected from the utility power system, except during tests.

Any combination of three-out-of-four divisions (EDGs) is acceptable for a single failure. However, for Emergency Core Cooling System (ECCS) requirements, an EDG operable configuration of two out of four 4 is also acceptable.

The EDGs are capable of supplying power to the loads necessary to shut down and cool down the associated unit safely. The diesel engine is a 12-cylinder, model 38-TD8-1/8 colt. The generator is a single bearing bracket, model TGZDJ Beloit Power Systems/Fairbanks Morse. Each diesel generator is rated at 2850 kW for continuous operation and at 3135 kW for two hours of short-time operation in any 24-hour period and is qualified to a 100-start test. The EDGs are selected so that their ratings satisfy the requirements of Regulatory Guide 1.9 (Reference 3). In addition, the diesel generators are capable of operating for extended periods of time at either low load or unloaded in the case of a Loss-of-Coolant Accident (LOCA) occurring with the availability of offsite power. For extended periods of low load operation (up to 30% load), the EDGs are operated at 50% load or greater for at least one hour in every 12-hour period. The manufacturer's recommendations are followed for loading up to 50% load. This prevents possible accumulation of combustion and lube oil products in the exhaust system. If a LOCA should occur and offsite power is available, the EDGs in the unit experiencing the LOCA would start automatically and run unloaded. After the offsite power grid, reactor parameters, and support systems have been stabilized and the LOCA signal reset, the unloaded EDGs would be

manually stopped and returned to standby. Even though the EDGs would not be expected to run in this condition for an extended period of time, the capability to manually load the diesel generators to remove possible combustion and lube oil products from the exhaust system is provided.

## 2.2 Current TS SRs

LGS TS have eight Surveillance Requirements (SRs) that specify EDG steady-state frequency and voltage acceptance criteria with uncertainty ranges and two SRs for ECCS pump flow acceptance requirements:

Table 2.2 Current Affected TS SR Requirements

| Surveillance Requirement | Description | Frequency (from current SFCP***) |
|---|---|---|
| SR 4.8.1.1.2.a.4 | Verify that the diesel can start* and gradually accelerate to synchronous speed with generator voltage and frequency at 4280 ± 120 volts and 60 ± 1.2 Hz. | In accordance with Surveillance Frequency Control Program |
| SR 4.8.1.1.2.e.2.b | Within 1.8 seconds following the load rejection, voltage is 4285 ± 420 volts, and frequency is 60 ± 1.2 Hz; and | “ |
| SR 4.8.1.1.2.e.2.c | After steady-state conditions are reached, voltage is maintained at 4280 ± 120 volts. | “ |
| SR 4.8.1.1.2.e.4.b | Verifying the diesel generator starts* on the auto-start signal, energizes the emergency busses within 10 seconds, energizes the auto-connected loads through the individual load timers and operates for greater than or equal to 5 minutes<br>while its generator is loaded with the shutdown loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained at 4280 ± 120 volts and<br>60 ± 1.2 Hz during this test. | “ |
| SR 4.8.1.1.2.e.5 | Verifying that on an ECCS actuation test signal, without loss-of offsite power, the diesel generator starts* on the auto-start signal and operates on standby for greater than or equal | “ |

| | | |
|---|---|---|
| | to 5 minutes. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the auto-start signal; the steady state generator voltage and frequency shall be maintained within these limits during this test. | |
| SR 4.8.1.1.2.e.6.b | Verifying the diesel generator starts* on the auto-start signal, energizes the emergency busses within 10 seconds, energizes the auto-connected shutdown loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the emergency loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained at 4280 ± 120 volts and 60 ± 1.2 Hz during this test. | “ |
| SR 4.8.1.1.2.e.8.b | Verifying that, within 5 minutes of shutting down the diesel generator after the diesel generator has operated* for at least 2 hours at an indicated 2700-2800 kW**, the diesel generator starts*. The generator voltage and frequency shall reach 4280 + 120 volts and 60 + 1.2 Hz within 10 seconds after the start signal. | “ |
| SR 4.8.1.1.2.h | In accordance with the Surveillance Frequency Control Program the diesel generator shall be started* and verified to accelerate to synchronous speed in less than or equal to 10 seconds. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the start signal. The diesel generator shall be started for this test by using one of the following signals: … | “ |
| SR 4.5.1.b.1 | Each CSS pump in each subsystem develops a flow of at least 3175 gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of ≥ 105 psid plus head and line losses. | “ |
| SR 4.5.1.b.2 | Each LPCI pump in each subsystem develops a flow of at least 10,000 gpm against a test line pressure corresponding to a reactor vessel to | “ |

| | | |
|---|---|---|
| | primary containment differential pressure of ≥ 20 psid plus head and line losses. | |

* This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warm-up procedures, and as applicable regarding loading and shutdown recommendations.

** This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

*** SFCP is Surveillance Frequency Control Program

## 2.3 Proposed TS SR Changes

Based on Design Analysis LM-0736, a steady state frequency tolerance of "≥ 59.8 Hz and ≤ 60.8 Hz" has been established to ensure minimum operability requirements with safety-related pumps, fans, and MOVs. In addition, the steady state voltages tolerance, which has not changed, has been clarified to be ≥ 4160 V and ≤ 4400 V. Also, the transient frequency and voltage requirements have been separated, as applicable, to remove any ambiguity between transient and steady-state requirements. The proposed changes are identified in red italics in the table below:

Table 2.3 Proposed TS SR Changes

| Surveillance Requirement | Description | Frequency (from current SFCP***) |
|---|---|---|
| SR 4.8.1.1.2.a.4 | Verify that the diesel can start* and gradually accelerate to synchronous speed with *steady-state generator voltage ≥ 4160 V and ≤ 4400 V and frequency ≥ 59.8 Hz and ≤ 60.8 Hz.* | In accordance with Surveillance Control Program |
| SR 4.8.1.1.2.e.2.b | Within 1.8 seconds following the load rejection, *the voltage is ≥ 3865 V and ≤ 4705 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and* | " |
| SR 4.8.1.1.2.e.2.c | After steady-state conditions are reached, voltage is maintained *≥ 4160 V and ≤ 4400 V and frequency ≥ 59.8 Hz and ≤ 60.8 Hz*. | " |
| SR 4.8.1.1.2.e.4.b | Verifying the diesel generator starts* on the auto-start signal, energizes the emergency | " |

| | | |
|---|---|---|
| | busses within 10 seconds, energizes the auto-connected loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the shutdown loads. After energization, the steady-state voltage and frequency of the emergency busses is *≥ 4160 V and ≤ 4400 V and ≥ 59.8 Hz and ≤ 60.8 Hz during the test.* | |
| SR 4.8.1.1.2.e.5 | Verifying that on an ECCS actuation test signal, without loss-of offsite power, the diesel generator starts* on the auto-start signal and operates on standby for greater than or equal to 5 minutes. *The generator voltage and frequency shall reach ≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz within 10 seconds after auto-start signal; the steady-state generator voltage and frequency shall be maintained ≥ 4160 V and ≤ 4400 V and ≥ 59.8 Hz and ≤ 60.8 Hz during this test.* | “ |
| SR 4.8.1.1.2.e.6.b | Verifying the diesel generator starts* on the auto-start signal, energizes the emergency busses within 10 seconds, energizes the auto-connected shutdown loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the emergency loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained *≥ 4160 V and ≤ 4400 V and ≥ 59.8 Hz and ≤ 60.8 Hz* during this test. | “ |
| SR 4.8.1.1.2.e.8.b | Verifying that, within 5 minutes of shutting down the diesel generator after the diesel generator has operated* for at least 2 hours at an indicated 2700-2800 kW**, the diesel generator starts*. The generator voltage and frequency *shall reach ≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz within 10 seconds after the start signal. After steady-state conditions are reached, voltage is maintained ≥ 4160 V and ≤ 4400 V and frequency is maintained ≥ 59.8 Hz and ≤ 60.8 Hz.* | “ |

| | | |
|---|---|---|
| SR 4.8.1.1.2.h | In accordance with the Surveillance Frequency Control Program the diesel generator shall be started* and verified to accelerate to synchronous speed in less than or equal to 10 seconds. The generator voltage and frequency shall reach *≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz* within 10 seconds after the start signal. *After steady-state conditions are reached, voltage is maintained ≥ 4160 V and ≤ 4400 V and frequency is maintained ≥ 59.8 Hz and ≤ 60.8 Hz.* The diesel generator shall be started for this test by using one of the following signals: … | “ |
| SR 4.5.1.b.1 | Each CSS pump in each subsystem develops a flow of at least *2500* gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of ≥ 105 psid plus head and line losses. | “ |
| SR 4.5.1.b.2 | Each LPCI pump in each subsystem develops a flow of at least *8000* gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of ≥ 20 psid plus head and line losses. | “ |

* This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warm-up procedures, and as applicable regarding loading and shutdown recommendations.

** This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

*** SFCP is Surveillance Frequency Control Program

In addition, the following two typographical errors will be addressed:

A typographical error in Unit 1 TS 3/4 .8.3.1.8.b will be corrected. The 480-VAC load center identified as “D224 (20B204)” will be revised to “*D244* (20B204).”

A typographical error in Unit 1 TS 4.8.1.1.2.e.2 will be corrected. The “c)” had been erroneously inserted into the middle of the TS 4.8.1.1.2.e.2.b wording and therefore the “c)” will be deleted.

A detailed markup of the TS has been included in Attachment 2.

In addition, a markup of affected TS bases has been included in Attachment 3 for information only.

## 3.0 TECHNICAL EVALUATION

### 3.1 WCAP-17308 Methodology

To evaluate the acceptability of the proposed changes, Exelon evaluated the proposed changes consistent with WCAP-17308-NP-A, Revision 0. The analysis and supporting calculations are contained in Exelon LM-0736, Revision 1, “Analyses of Emergency Diesel Generator Technical Specification Voltage and Frequency Range and Tolerances” (Reference 1).

Specifically, the following items were evaluated for changes in steady-state voltage and frequency:

- Impact on Safety-Related Systems which include ECCS
- Impact on DG Loading
- Impact on DG Fuel Oil Consumption Calculations
- Impact on MOV Performance

Pumps:
Pump data is tabulated in LM-0736 Attachment H. Load data is obtained from Exelon analysis 6380E.07 (Reference 4) and 6300E.18 (Reference 5). Motor synchronous speed and nominal (running) speed are obtained from associated motor outline and/or induction motor data sheets as referenced in LM-0736 Attachment H. Various pumps are connected to the EDG during a Design Basis Accident as described in the UFSAR Table 8.3-3 and analysis 6380E.07. Attachment 5 provides a list of analyzed safety related pumps.

Fans/Blowers/Compressors:
Fan/Blower data is tabulated in LM-0736 Attachment J. Load data is obtained from analysis 6380E.07 and 6300E.18. Motor synchronous speed and nominal (running) speed are obtained from associated motor outline and/or induction motor data sheets as referenced in LM-0736 Attachment J. Various Fans/Blowers are connected to the EDGs during a Design Basis Accident as described in the UFSAR Table 8.3-3 and analysis 6380E.07. Attachment 6 contains a list of analyzed fans/blowers.

MOVs:
Attachment 7 contains a list of MOVs analyzed for valve thrust, torque and stroke time impacts.

Equipment Performance Requirements:
The performance requirements of the driven pumps, fans/blowers, MOVs, and other equipment are not being changed; therefore, their impact is not being evaluated in this LAR. The TS for LGS contain SRs within TS 3.8.1, "AC Sources-Operating," that place limits on the EDG frequency and voltage ranges under steady-state conditions. These Initial tolerances, however, were derived from EDG starting and loading transient criteria from Regulatory Guide (RG) 1.9. Since the wording of the TS SRs would allow steady-state EDG operation within those limits,

the NRC has challenged licensees as to whether the impacts of the allowable tolerances in steady state EDG frequency and voltage have been evaluated with respect to the performance of the affected equipment and existing analyses. In response to this challenge, an administrative limit for EDG steady-state frequency was established.

The following is a list of justified minor deviations from the WCAP-17308-NP-A methodology:

Electrical:

- Per Section 3.1.1 of WCAP-17308-NP-A, the impact of frequency variation on EDG loading is to be determined by assuming that the EDG entire load is an induction motor and the increase in frequency is determined by a factor using the pump/fan affinity laws (e.g., speed increases by a cubic factor). A more realistic approach of separating the load profile out by either induction motor, static, or lumped load, then applying the appropriate factor based on the load's behavior to the effects of frequency and voltage changes was utilized. The load factor for induction motors was derived by using the equation 5 in WCAP-17308-NP-A to determine the uncertainty in motor speed then applying classical machine theory to determine the impacts on power changes. The load factor for static loads was derived by using classic electrical power laws. This results in not only a more realistic result but also a more conservative result since, in Limerick's case, static loads provide a higher load factor than induction loads due to the voltage variation being larger.

Mechanical:
For WCAP pump evaluations, Limerick utilized either the system preoperational test data pump curves, IST preservice five-point pump curves, or certified Original Equipment Manufacturer (OEM) pump curves when in-situ data was unavailable.

At the time of initial preservice testing, the 1986 edition of ASME Section XI required a single preservice reference point at normal operating speed to satisfy the code. The 5-point curve preservice testing requirement was instituted in the 1995 edition of the OM and since January of 2010, Limerick is committed to acquire preservice five-point curve to establish a new reference value if a pump is replaced or performance is significantly modified. The Emergency Service Water (ESW) and Residual Heat Removal Service Water (RHRSW) pumps were replaced and per the committed code of record have IST preservice 5-point pump curves. Exelon is currently committed to ASME OM code, 2012 edition. As currently committed, Appendix V will be used to perform a pump periodic verification test once per two years at the pump design flow and pressure conditions while accounting for instrument accuracies in the test acceptance criteria.

- The technical specification references listed by WCAP-17308-NP regarding fan acceptability do not encompass General Electric-built plants. However, Limerick Tech Specs 4.6.5.3, 4.6.5.4, and 4.7.2.1 and NUREG 1433, require that flow rates for Standby Gas Treatment subsystem, Reactor Enclosure Recirculation subsystem and Control Room Emergency Fresh Air Supply subsystem not vary more than 10% from their nominal flow rates. Therefore, the modified fan performance for the Standby Gas Treatment System Exhaust Fan, Reactor Building Recirculation Fan, and Control Room

Emergency Fresh Air Fan are deemed acceptable so long as the flow rates do not vary more than 10% from their nominal flowrates.

The acceptability of fans not included within the scope of Limerick TS 4.6.5.3, 4.6.5.4 and 4.7.2.1 is evaluated based on the ability of the fans to provide sufficient cooling to their respective systems.

MOVs:

- The frequency and voltage uncertainties are treated as an added uncertainty similar to how MOV testing uncertainties are evaluated. This WCAP described uncertainty is shown to be small relative to the pre-existing test uncertainty for all valves in the MOV testing population. The additional uncertainties are combined with the existing MOV testing uncertainty using standard square-root-sum-of-the-squares methods when the uncertainties are independent, and by sum when the uncertainty is not independent. The result is effectively an increased testing variability, which is compared against the existing valve capabilities. All valves are found to have sufficient margin to existing valve capabilities even upon imposing this increased uncertainty.

## 3.2 Impact Areas

3.2.1 EDG Loading:

Impact of Frequency Variation on EDG Loading:
Per WCAP-17308-NP-A Section 3.1.1, an underfrequency would not negatively impact diesel generator loading calculations. By applying the upper bound of frequency (> 60 Hz) allowed by the EDG governor to the maximum inductive loads calculated for the EDG, an additional power load can be calculated for the potential variation in frequency allowed by the EDG governor operating range.

Example calculation using WCAP-17308 Equation #5 for calculating the additional diesel loading contributed by the 1A RHR Pump due to the proposed EDG TS SR frequency band:

Equation 5 from WCAP is: $U_\omega = \left(\left(\frac{V_{Nom}\times(f_{Nom}+U_f)}{(V_{Nom}-U_V)\times f_{Nom}}\right)^2 - 1\right)\times(\omega_S-\omega_{Nom}) + \left(\frac{f_{Nom}+U_f}{f_{Nom}}-1\right)\omega_{Nom}$

Where,
$U_\omega$ = uncertainty in pump speed associated with uncertainties in EDG frequency and voltage (rpm)
$f_{Nom}$ = nominal supply frequency, 60 Hz
$\omega_{Nom}$ = nominal operating speed of motor at nominal frequency and voltage (rpm)
$V_{Nom}$ = nominal supply voltage, 4280 V
$\omega_S$ = synchronous speed of motor (speed at zero torque and zero slip) (rpm)

Equation 5 expressed as a ratio is:

$$\frac{U_\omega}{\omega_{Nom}} = \left(\left(\frac{1+\frac{U_f}{f_{Nom}}}{1-\frac{U_V}{V_{Nom}}}\right)^2 - 1\right) * \left(\frac{\omega_S}{\omega_{Nom}} - 1\right) + \left(\frac{U_f}{f_{Nom}}\right)$$

The increased load on the EDG due to voltage and frequency variations including their uncertainties is given by the following equation for induction motors:

$$P = P_{Nom}\left(1 + 3\frac{U_{\omega}}{\omega_{Nom}}\right)$$

| LOAD | EQUIP NO | RATING (HP) | RATED kV | SLIP (%) | Sync Speed | Nom Speed | Uω | Load Factor | New kW | New kVAR | kW (6380E.07) | kVAR (6380E.07) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A RHR PUMP | 1A-P202 | 1250 | 4 | 1.67 | 1200 | 1180 | 17.78 | 1.045 | 1037.87 | 530.47 | 993.00 | 507.53 |

Exelon Calculation 6380E.07 is the existing EDG Load calculation (Reference 4).

Impact of Voltage Variation on Diesel Generator Loading:
Per WCAP-17308-NP-A Section 3.1.2, the voltage variation of the EDG voltage regulator at steady-state operation should be confirmed to be within the allowable operating voltage range for the motors powered by the EDG. The effect of voltage variation from the nominal voltage rating of the EDG would cause the current of the motor load circuits to decrease or increase accordingly. The net change in power required by the loads on the EDG should be evaluated for lower than nominal voltage and frequency conditions, where there is a change in the power factor and real and reactive portions of the current. Since the real power is a function of the governor controls and reactive power is controlled by the EDG exciter and voltage regulator, the overall impact of EDG output voltage should be considered for real and reactive components of the EDG loading evaluation.

3.2.2 EDG Fuel Consumption:

Per WCAP-17308-NP-A Section 3.2, a calculated change in diesel generator loading due to steady-state variation in frequency will also require a commensurate evaluation of the impact on fuel oil consumption and stored fuel requirements as a result of the change in loading.

3.2.3 Fan/Blower Performance:

Per WCAP-17308-NP-A Section 5, calculating the change in fan performance due to small diameter changes, speed variations, and density fluctuations is a matter of multiplying by ratios of the target parameter to the initial parameter (raised to some power). These are the fan/blower affinity laws. Both direct drive and belt drive fans would be impacted in the same manner by EDG frequency and voltage variations.

For the upper bound of the EDG governor control band, the main concern from a higher than nominal frequency value (> 60 Hz) would be the additional power load required from the EDG. This additional power requirement would be addressed in the diesel loading calculation as described in Section 3.3.1.

The lower range of the EDG governor control band, frequency < 60 Hz, would cause a slight reduction in motor speed (rpm) and a decrease in fan performance exhibited by reduced

airflow (cfm) and static pressure (SP) as indicated by the fan/blower affinity laws. For air filtration systems, Limerick TS 4.6.5.3, 4.6.5.4, and 4.7.2.1 and NUREG 1433 require that each Engineered Safety Feature (ESF) filter system be tested at ±10% of the specified system flow rate. Therefore, if the fan speed and corresponding airflow do not vary more than ±10% of the specified system flow rate from the effect of EDG frequency and voltage variation, the fan for that system can be said to be performing within its expected operating range

The effect of voltage variation in excess of the nominal voltage rating of the fan/blower motors would cause the current of the motor load circuits to increase or decrease accordingly. The voltage variation of the EDG voltage regulator at steady-state operation should be confirmed to be within the allowable operating voltage range for the fan/blower motors to ensure that there would be no adverse impact to the fan/blower motors from the minimum and maximum expected steady-state voltage allowed by the voltage regulator.

3.2.4 Pump Performance:

Per WCAP-17308-NP-A Section 2.1, the total pump head uncertainty is calculated at discrete flow rates as a function of the combined uncertainties for frequency, voltage, and various other measurements including flow and pressure. Therefore, flow variability due to measurement uncertainties and the effects of frequency and voltage on pump speed are statistically factored into the pump head uncertainty. For the simultaneous underfrequency and undervoltage event, the decrease in pump flow rates are evaluated to ensure ECCS acceptance criteria remain acceptable. For the simultaneous overfrequency and overvoltage event, the increase in pump flow rates is evaluated to ensure Net Positive Suction Head (NPSH) requirements are met and MOV operation is acceptable.

3.2.5 MOV Operation:

Per WCAP-17308-NP-A Section 4, the impact of frequency and voltage variation on motor-operated valves (MOVs) would be similar to the impact on other inductive motors such as pump motors. A higher than nominal frequency would increase the speed of the motor while a lower frequency would slow the motor speed. All rotating machinery powered by the EDG output would be affected by a change in frequency in a similar manner (but specific to each motor).

Since the MOVs are powered by the 480V system, the EDG bus frequency translates directly through the step-down transformer; if 59 Hz power is provided in the primary (high voltage) side of the transformer, then 59 Hz power at the secondary side (low voltage) transformer terminals will result. It can be noted that a change in frequency affects the reactance of a transformer and, as a result, the output voltage on the secondary side is affected as well. For this study (maximum frequency variations of 2% or less), it can be assumed that any change in transformer reactance and secondary side voltage is negligible. EDG output frequency will carry through the step-down transformer to the motor control centers (MCCs), to the MOVs.

3.2.5.1 Impact of MOV Motor Speed Change:

Per WCAP-17308-NP-A Section 4.1, the MOV design calculated stroke times are based on

typical design speeds of 1725 and 3440 rpm for alternating current (AC) motors. Unless it is determined that the MOV motor speeds resulting from the reduced frequency are lower than these design speeds, the stroke times will not be affected. A slightly faster valve stroke time, caused by an increase in motor speed due to higher than nominal frequency, will not affect the valve performance in an adverse manner.

3.2.5.2 Impact of Frequency Change on MOV Inertia:

Per WCAP-17308-NP-A Section 4.2, the inertia of a motor-operated valve is associated with the moving parts of the valve assembly and consists of the sum of the inertias of the motor, the gear train, and the stem-disc assembly. The effect of rotational inertia is to do work when the valve closes by creating a force and a displacement. The force is the inertial effect measured during diagnostic testing. As the moving parts move at different speeds, it is customary to calculate an equivalent inertia. The equivalent inertia is the sum of inertias of the moving parts. In MOVs, the inertia effect on load is measured after static tests as the difference in thrust from closed torque switch trip (CST) and hard seat. The energy contribution of the components is proportional to the square of the rotational speed of the component and, for a linear system, it is proportional to the square of the velocity. Note that linear velocity is proportional to rotational speed. Thus, for all the components of the assembly, the energy is a function of the square of the rotational speed. Since frequency is directly proportional to rotational speed, a change in frequency changes the rotational speed proportionately. Thus, a change in frequency will change the energy content taking into account the square of the rotational speed effect.

3.2.5.3 Impact of MOV Voltage:

Per WCAP-17308-NP-A Section 4.3, as part of calculations performed to comply with Generic Letter (GL) 96-05, the MOV calculations are based on worst-case derated voltage conditions. There would be no change in the calculation results unless the low-end voltage range for the EDG voltage regulator is less than the derated voltage condition analyzed in the MOV calculations. For typical AC motor and actuator applications, voltage variation from 90% – 100% will not affect the output torque outside its operating range if the nominal ratings are used. The effect of voltage variation in excess of the nominal voltage rating of the MOV motors would cause the current of the motor load circuits to decrease accordingly. The voltage variation of the EDG voltage regulator at steady-state operation should be confirmed to be within the allowable operating voltage range for the MOV motors to ensure that there would be no adverse impact on the MOV motors from the maximum expected steady-state voltage allowed by the voltage regulator.

3.2.5.4 Impact of Pump Output Pressure/Differential Pressure (DP) on the MOV:

Per WCAP-17308-NP-A Section 4.4, an increase in pump output pressure and, consequently, the differential pressure caused by a higher than nominal frequency will create a higher DP at the valve. For those MOV calculations that are based on the vendor pump performance curve at 0 flow rate, i.e., shutoff head, the calculations would be affected if the pump head increased above the nominal shutoff head. This would be a concern for the high end of EDG frequency range. For any MOV calculation done at a DP lower than the pump shutoff head, the following conditions shall be satisfied to ensure that

the valve remains operable. An increase in frequency increases the rotational speed, which increases horsepower using affinity laws. Similarly, an increase in rotational speed increases pump developed head using affinity laws. Therefore, the effect of the increase in pump output pressure / differential pressure on MOVs due to the frequency change reduces the available margin. The MOV is operable if the initial margin is greater than 2.4%. For cases when the analyzed output pressure / differential pressure exceeds the actual pump output pressure / differential pressure by 1.2%, the valve is operable. This margin relationship applies to rotary valves also.

**3.3 Results of Design Analysis LM-0736**

3.3.1 EDG Loading:

Undervoltage:
Per LM-0736 Section 8.1.1 - Analysis performed in 6300E.23 demonstrates that the safety-related loads met the performance requirements under degraded voltage condition. The degraded voltage analysis was carried out at the design limit of 3861 volts, which is the minimum required voltage on the 4.16 kV bus during steady state off site source operation. Therefore, the analysis that was performed based on 3861 volts at 4 kV bus is bounding the EDG lower uncertainty voltage of 4158 volts.

Overfrequency and Overvoltage:
Per LM-0736 Section 8.1.2 - The EDG maximum loading (Units 1 & 2 in operation; Unit 1 Design Basis Accident (LOOP concurrent with LOCA); Unit 2 spurious LOCA; D11 EDG out of service with the remaining seven (7) EDGs in service) when the D12 EDG is operating at +1.36% overfrequency and +5.1% overvoltage occurs at 0-10 minutes into the accident. The EDG has a continuous rating (8760 hrs.) of 2850 kW. The EDG loading at maximum frequency and voltage variation on D12 with D11 out of service is 2487 kW which provides 363 kW of margin from the continuous rating.

EDG Skid Mounted Equipment:
The EDG vendor (Fairbanks Morse) was contacted to address the impact of operating the Emergency Diesel Generators at the current TS allowable frequency band of 60Hz ± 2%, which bounds the proposed frequency band of 59.8 Hz to 60.8 Hz. On a communication provided by the vendor (Reference 6), the vendor stated that within the allowable torque rating and speed not exceeding noted ± 2%, Fairbanks Morse warrants the engine for sustained operation. As the plant has been operating for some years without issues, Fairbanks Morse determined that there is no basis for a more detailed study to support that the diesel engine and generator operation at sustained speeds of ±2% of rated could cause operating issues.

3.3.2 EDG Fuel Consumption:

Per LM-0736 Section 8.2 - The fuel oil consumption invariably increases due to overvoltage and overfrequency because the EDGs are using more power. As described in LM-0736 Section 7.2, the maximum fuel oil consumption is on EDG D11 utilizing 33,444 gallons which is 56 gallons below the minimum required 33,500 gallons for a 7-day LOCA/LOOP, as computed in LM-0736 Attachment L. The approach conservatively assumes that this maximum load stays constant during the entirety of a 7-day LOCA/LOOP. In reality, the load is split in such a way that the first

0-10 minutes of an accident will see a higher load than 10 mins – 7 days. Using this approach still leaves margin at each API gravity instance. Therefore, there is no reason to evaluate fuel oil consumption using the less-conservative time-rated approach.

3.3.3 Fan/Blower Performance:

Per LM-0736 Section 8.3 - The fan/blower performance carried out in the analysis shows a reduction in speed dependent on the motor slip calculated for each fan and the WCAP methodology for calculating decreased air flow due to simultaneous undervoltage and underfrequency. The SGTS Exhaust Fan, Reactor Enclosure Recirculation Fan, and CREFAS Fan are deemed acceptable because their respective flow rates at undervoltage and underfrequency vary by less than 10% of their nominal flow rates. The other fans were evaluated based on their ability to remove heat at their reduced flow rates. Using margin from several Limerick heat load calculations, all referenced in Section 4.0, and engineering judgment, it is determined that the small reduction in cooling capacity at undervoltage and underfrequency additions is insufficient to overcome the margin in heating load on these fans. Therefore, the fans are deemed acceptable.

At overvoltage and overfrequency, the fans within the scope of Limerick TS 4.6.5.3, 4.6.5.4 and 4.7.2.1 are deemed acceptable due to their ability to maintain their respective flow rates within 10% of their nominal flow rates. Note that the Standby Gas Treatment subsystem has pressure control dampers, the Reactor Enclosure Recirculation subsystem has flow control dampers and the CREFAS subsystem has flow and pressure control dampers that will compensate and maintain their respective TS flow rates tolerances. In addition, each independent train of CREFAS and MCR supply and exhaust fans are powered from an independent Class 1E power source; therefore, MCR habitability will not be challenged at the proposed EDG frequency range since the system will be capable of maintaining a positive pressure above atmospheric to inhibit unfiltered air leakage into the control room areas. The other fans are acceptable by engineering judgment as they are expected to provide more cooling at the higher end of the proposed EDG frequency.

At the proposed TS frequencies, it is noted that there may be minor changes of in-leakage in the main control room. Per engineering judgment, these minor changes will not affect the MCR habitability and are considered acceptable.

3.3.4 Pump Performance:

Per LM-0736 Section 8.4.1 & 8.4.2 - At undervoltage and underfrequency, the speed of the pumps decreased by less than 1% with specific results provided in LM-0736 Attachment D. The speed increased between 1-2% for each pump at overfrequency and overvoltage, with specific results provided again in LM-0736 Attachment D. The discharge pressures on safety-related pumps decreased at underfrequency conditions and increased at overfrequency conditions.

RHR:
The RHR pumps are able to perform their accident mitigation functions by producing a flow of 8000 gpm at 150 psi discharge pressure. This acceptance criteria is taken from the GE LOCA Analysis of Record (see calculation LM-0736 Section 7.6.1.1) instead of the current TS minimum of 10,000 gpm. The WCAP methodology for reducing the pump discharge pressure is

applied to each flow point to determine the new discharge pressure at underfrequency. At underfrequency conditions, each pump exceeds the minimum discharge pressure of 150 psi at 8,000 gpm flow:

| RHR Pump | Discharge Pressure at 8000 gpm (psi) |
|---|---|
| 1A | 211.25 |
| 1B | 218.72 |
| 1C | 216.40 |
| 1D | 220.48 |
| 2A | 226.75 |
| 2B | 229.20 |
| 2C | 224.10 |
| 2D | 225.97 |

**LM-0736 Table 8.4.2.1: RHR Pumps Performance At Decreased Speed With Respect To Their Acceptance Criteria**

There are no concerns of pump cavitation at overfrequency and overvoltage conditions. Sufficient margin remains to accommodate the pump speed increase.

Core Spray:
The acceptance criteria of the Core Spray pumps at Limerick are evaluated with respect to their GE LOCA analysis instead of the TS minimum 3,175 gpm per Core Spray pump. The pumps are deemed acceptable if each loop can produce 250 psi discharge head at 5,000 gpm flow. Note that, by design, each pump is running at 50% (2,500 gpm) capacity in each loop.

LM-0736 Table 8.4.2.2 below shows the results of the Core Spray pumps at decreased speed, as per WCAP methodology:

| **Core Spray Pump** | **Discharge Pressure at 5000 gpm (loop) or 2500 gpm (individual) (psi)** |
|---|---|
| 1A Core Spray Loop (1A and 1C pumps) | 319.29 |
| 1B Core Spray Loop (1B and 1D pumps) | 321.55 |
| 2A Individual | 311.58 |
| 2B Individual | 301.61 |
| 2C Individual | 318.95 |
| 2D Individual | 297.73 |

**LM-0736 Table 8.4.2.2: Core Spray system performance at decreased speed with respect to acceptance criteria**

There are no concerns of pump cavitation at overfrequency and overvoltage conditions. Sufficient margin remains to accommodate the pump speed increase.

Suppression Pool Cooling and Suppression Pool Spray Modes of RHR:
Utilizing the values from Attachment D of LM-0736, which considers the impact of frequency and voltage, a 0.53% ( = 1 – 1173.72/1180) reduction in speed is expected at the lower frequency of 59.8 Hz. The reduction in speed from nominal will not impact the RHR pump's ability to provide the design rated shell side heat exchanger flow of 10,000 gpm for post-accident decay heat removal or the 500 gpm for suppression pool spray flow. Although a lower pump speed affects both flow and total developed head, the full flow test return valves are throttled when RHR is in the suppression pool cooling or suppression pool spray mode of operation. At 59.8 Hz, the slight decrease in pump performance is addressed by further opening the throttled valve. Therefore, a 0.53% reduction in pump speed will not affect post-accident RHR cooling flow. Operating above 60.0 Hz produces more pump flow and head. Further closing the throttled valve addresses this condition.

ESW*:*
ESW pump performance is based on the pump's ability to support heat transfer of the components cooled by the ESW loop under the design basis system operating mode regardless of discharge head. The minimum required ESW flow rates for individual components are administratively controlled based on cooler fouling. The ability of the ESW pumps (weakest per loop) to supply the minimum required cooling water flow rates to components cooled by the ESW System under the design basis system operating mode is periodically demonstrated. The minimum required ESW pump flow rate under the design basis system operating mode is

3,392.4 gpm. Therefore, the ESW pumps are deemed acceptable at undervoltage and underfrequency (Ref. Section 7.6.1.3 of LM-0736). Sufficient margin remains to accommodate the pump speed increase at overfrequency and overvoltage conditions. The ESW system also operates well below its runout conditions, and operators would get a low-pressure alarm well in advance of cavitation should it occur (Ref. Section 4.86 of LM-0736). Therefore, there is no concern of pump cavitation due to overvoltage and overfrequency conditions.

RHRSW*:*
RHRSW pump performance requirements are based on the pump's ability to support heat transfer regardless of discharge head. For two-unit operation, during a plant operating mode in which one unit is in an accident shutdown (LOCA) and the other unit is in a normal shutdown (including LOOP occurring during normal shutdown), with one RHRSW loop in service (two RHRSW pumps in operation, and one ESW pump in operation using RHRSW return header and two spray networks), the unit undergoing normal shutdown will be supplied with 5570 to 8000 gpm of RHRSW flow to the RHR heat exchanger. The unit in an accident shutdown will still be supplied with 8000 GPM of RHRSW flow to the RHR heat exchanger. Each of the four RHR heat exchangers is maintained such that a minimum RHRSW flow of 5570 gpm will ensure that the minimum required heat removal duty is met. The spray efficiency is determined for the minimum spray network flow rate of 8500 gpm. This flow corresponds to the minimum flow of two RHRSW pumps and one ESW pump divided between two spray networks. Reference Section 7.6.1.2 of LM-0736 for applicable references.

At overfrequency and overvoltage, the pumps are running at a higher speed. This may introduce a concern of pump cavitation by increasing the NPSH required. However, this concern is eliminated by the fact that the output flow can be throttled by operators when operating the RHRSW system, thus allowing them to control the flow to the desired rate. Therefore, there is no concern of pump cavitation due to overvoltage and overfrequency conditions.

Control Room Chiller Water Pumps:
Some conservatism had to be removed to ensure that the Control Room Chiller Water Pumps met the acceptance criteria outlined in their respective IST requirements. LM-0736 Table 7.6.46 from LM-0736 Section 7.6 shows the results of the Control Room Chiller Water Pump evaluation at decreased speed due to undervoltage and underfrequency:

| Pump | Discharge Pressure at 600 gpm (psi) | Acceptance Criteria at 600 gpm (psi) |
|---|---|---|
| 0A-P162 | 39.51 | 39.2 – 47.8 |
| 0B-P162 | 39.17 | 37.2 – 45.4 |

**LM-0736 Table 7.6.46: Control Room Chiller Water Pumps Discharge Pressure Versus Acceptance Criteria**

There are no concerns of pump cavitation at overfrequency and overvoltage conditions. The Control Room Chiller Water Pumps are therefore deemed acceptable within the scope of LM-0736.

Safeguard Piping Fill Pumps:
The Safeguard Piping Fill Pumps are deemed acceptable at decreased speed due to undervoltage and underfrequency as depicted in LM-0736 Table 7.6.41:

| Safeguard Piping Fill Pump | Discharge Pressure at 30 gpm (psi) |
|---|---|
| 1A-P256 | 58.57 |
| 1B-P256 | 58.57 |
| 2A-P256 | 59.67 |
| 2B-P256 | 60.13 |

**LM-0736 Table 7.6.41: Safeguard Piping Fill Pumps Discharge Pressure**

The NPSH required for the Safeguard Piping Fill Pumps is 2.75 ft (Ref. Section 4.71 of LM-0736). The NPSH available is 18.07 ft. A 1.64% maximum increase in speed will have a negligible effect on the NPSH margin. Therefore, there is no concern of cavitation at overvoltage and overfrequency. The Safeguard Piping Fill Pumps are therefore deemed acceptable within the scope of LM-0736.

Diesel Fuel Oil Transfer Pumps:
The Diesel Fuel Oil Transfer pumps operate nominally at 20 gpm flow (Ref. Sections 4.72 through 4.79 of LM-0736). The minimum flow requirement for the diesel fuel oil transfer pump is 3.323 gpm to transfer the entire 33,500 gallons of fuel in the storage tank to the day tank throughout seven days of a LOCA/LOOP ((33,500 gallons / (24(hrs./day) * 7 days)) / (60 (mins/hr.)) = 3.323 gpm). Since the margin between the nominal flow and the minimum flow is significantly higher, the pump is deemed acceptable at underfrequency and undervoltage by engineering judgment. The effect on NPSH required during overvoltage and overfrequency is also negligible. The Diesel Fuel Oil Transfer Pumps are therefore deemed acceptable within the scope of LM-0736.

Positive Displacement Pumps:

- Standby Liquid Control Pumps:
  The Standby Liquid Control pumps at Limerick operate at a nominal flow of 43 gpm. The flowrate at undervoltage and underfrequency is well above the TS minimum of 37 gpm. The effect on NPSH required due to overvoltage and overfrequency is negligible. Therefore, the Standby Liquid Control pumps are deemed acceptable within the scope of LM-0736.

- Control Room Chiller Oil Pumps:
  The Control Room Chiller Oil Pumps operate at 33 gpm and are deemed acceptable above 30 gpm, which represents a flowrate margin of 10% above the minimum. At undervoltage and underfrequency conditions, the decrease in flow is negligible. The effect on NPSH required during overvoltage and overfrequency is also negligible. The Control Room Chiller Oil Pumps are therefore deemed acceptable within the scope of LM-0736.

Compressors:
The Control Room Enclosure Chiller 0A and 0B-K112 were the only safety-related compressors within scope. The Control Enclosure Chillers have a revised rating of 192 tons and a minimum required cooling capacity of 157.3 tons. A margin of 34.7 tons is available with an additional assumed cooling load margin of 7%. This margin is sufficient to bound any decreases in cooling capacity as a result of speed decrease at undervoltage and underfrequency conditions. Therefore, the compressor is deemed acceptable within the scope of LM-0736.

Relief Valve Lift
The pressure relief valve setpoints associated with the centrifugal pumps were determined by using the shutoff head pressure of its associated pump. Sufficient margin exists between the expected pressure at the design flow and the shutoff head pressure to preclude lifting a relief valve during a design basis accident. Therefore, the affected pumps will operate within the limits of the relief valves. In addition, the increase in speed does not affect the discharge pressure of positive displacement pumps; therefore, there are no concerns that at a higher frequency of 60.8Hz, a safety relief valve would lift affecting the design functions of the systems.

<u>3.3.5 MOV Operation:</u>

Terminal Voltage:
Per LM-0736 Section 8.5.1 - All MOVs are acceptable given the EDG voltage uncertainty described in LM-0736 Section 7.1. This is based on the determination that the MOV thrust calculations were considered acceptable using a fixed 480V MCC voltage of 432V (90% of rated). Analysis performed in 6300E.23 (Reference 7) demonstrates that the safety-related loads met the performance requirements under degraded voltage condition. The degraded voltage analysis was carried out at the design limit of 3861 volts, which is the minimum required voltage on the 4.16 kV bus during steady state operation. Therefore, the analysis that was performed based on 3861 volts at 4 kV bus is bounding the EDG lower uncertainty voltage of 4158 volts.

Inertia Effect:
Per LM-0736 Section 8.5.2 - The inertia effect due to the increased frequency is analyzed for the AC motor valves for the impact on thrust for gate valves and non-rising rotating stem globe valves. This inertial effect on torque is analyzed for AC motor valves for valves where torque is measured in place of thrust, such as for butterfly valves as well. The MOV inertia evaluation demonstrates the maximum allowable MOV thrust or torque (as applicable) are not exceeded. All analyzed valves are operated with a thrust or torque below the maximum allowable with margin ensuring the frequency uncertainty impact is minimal relative to the maximum valve thrust / torque capabilities. Thus, the respective valve integrity remains acceptable. In addition, even upon imposing the additional thrust due to the frequency uncertainty, sufficient margin still

exists for all analyzed valves to provide assurance that all valves continue to be within thrust / torque capabilities even upon considering typical valve testing variances.

Differential Pressure:
Per LM-0736 Section 8.5.3 - The MOV differential pressure was analyzed to assess the effect of the frequency uncertainty due a combined inertial effect and differential pressure on the analyzed MOVs. This frequency uncertainty is an uncertainty independent of the other MOV testing uncertainties. As independent uncertainties can be combined, it is shown that the frequency uncertainty impact has minimal impact on the overall test uncertainty, which is, in turn, used to establish valve operability. As the frequency uncertainty has minimal impact on the valve MOV testing, and the valve testing limits has included margins to the overall valve thrust / torque capabilities, then the frequency uncertainty is shown to have a negligible impact versus valve capabilities. The increased uncertainty is shown to be less than 1% for all analyzed valves, so all valves are assessed fully capable of withstanding any potential adverse effects due to the frequency uncertainty which may be impacted when the EDG is operating within the bounds of the established frequency uncertainty. Therefore, the MOVs remain operable given the range of the expected EDG frequency uncertainty.

Stroke Time:
Per LM-0736 Section 8.5.4 - The impact of stroke time is insignificant and therefore is not a concern when the motors are operating within the bounds of the EDG frequency uncertainty. A review of all the MOV stroke time requirements shows that all MOVs that may be powered from the EDG stroke within the required times given the expected frequency uncertainty range.

ESW/RHRSW Flow Balance Impact:
The results provided in LM-0736 Attachment AA indicate that there is no adverse impact on the ESW and RHRSW flow balance at both underfrequency and overfrequency operation.

Spray Pond Temperature Impact:
The results provided in LM-0736 Attachment AA indicate that there is no adverse impact on spray pond temperature increase at overfrequency operation.

## 3.4 ECCS Pump Flow SR Acceptance Criteria

The results shown in calculation LM-0736 for LPCI and Core Spray (CS) do not meet the required TS flow value of 10,000 gpm and 3,175 gpm, respectively. They do, however, exceed their respective pump flow values of 8,000 gpm and 2,500 gpm contained in the 10CFR50.46 Analysis of Record (AOR) - 0000-0111-9078 (Reference 8) for the GNF2 fuel evaluation, and 005N3990 (Reference 9) for the GNF3 fuel evaluation. These documents provide the results of the LOCA analysis performed by GNF, Global Nuclear Fuel, for LGS Units 1 and 2. The ECCS-LOCA analysis for the GNF2 fuel was performed using the NRC approved SAFER/GESTR-LOCA methodology (Reference 14) and supplemented by the implementation of the PRIME methodology (Reference 10). The ECCS-LOCA analysis for the GNF3 fuel was performed using the NRC approved SAFER/PRIME methodology (Reference 9 and 14). The analyses were performed in accordance with NRC requirements and demonstrate conformance with Emergency Core Cooling System (ECCS) acceptance criteria of 10CFR50.46 and 10CFR50 Appendix K. The GNF report evaluates sufficient number of plant-specific break sizes/break

locations, and single failure scenarios to establish the behavior of both the nominal and Appendix K Peak Cladding Temperature (PCT) as a function of break size and identify the limiting scenario. The ECCS-LOCA analysis concluded that the Licensing Basis PCT conforms to all the requirements of 10CFR50.46 and Appendix K. Based on the above, LGS decided to revise the ECCS values to match the LOCA AOR.

The CS surveillance requirements (SR) are based upon the most limiting process conditions as determined through application of the 10CFR50.46 (10 CFR 50, Appendix K) criteria for the initial post LOCA short term injection/reflood phase. The CS loop flow test return lines were specifically designed and sized to accommodate testing to simulate LOCA conditions when the Reactor Pressure Vessel (RPV) is 105 psid above drywell pressure in accordance with the General Electric Limerick CS system process diagram.

After the short term reflood phase of the LOCA is completed, a single CS loop is required to provide 6,350 gpm (design flow) of long-term spray cooling post-accident when the reactor vessel is at atmospheric pressure. These process conditions solely satisfy 10CFR50.46 criterion 5 instead of performing a rigorous long-term cooling 10CFR50.46 analysis like the short-term phase that satisfy 10CFR50.46 criterion 1 thorough 4 and are the basis of the CS TS SR. It should also be noted that maintaining the reactor water level above top of active fuel (TAF) during the long-term cooling phase also satisfies criterion 5. Limerick has four independent ECCS divisions and qualitatively there would be enough combined LPCI and CS total flow to maintain water level above TAF. At LGS both the LPCI and CS injection flow paths provide water above the core within the shroud. The injection flow first passes through the core before exiting the reactor vessel through the postulated Design Basis Accident (DBA) LOCA break.

As demonstrated during CS system preoperational testing, there is more than 1,000 gpm of flow margin for core spray sparger flow with the vessel at atmospheric pressure. Therefore, the small system flow variations due to the EDG operating within the proposed frequency band will continue to satisfy this long-term cooling requirement provided by the CS system. The RHR system LPCI mode is not credited to satisfy this requirement. By design its function cools the core by flooding, and not spraying, the core post-accident with a large volume of water. Because a larger amount of pump flow and system flow margin would be available at zero reactor pressure, the more limiting TS SR injection requirement with the RPV pressurized was chosen during initial plant design and licensing as the appropriate routine single test point to ensure that the pump performance has not degraded during the operating cycle.

Upon further review, LGS identified that the generic analysis for line breaks in both NEDO-24708A (Reference 11) and NEDC-30936P-A (Reference 12) forms the basis of certain Limerick ECCS TS limiting conditions for operation as described in UFSAR Chapter 6.3, Section 6.3.1.1.2.o. for ECCS Reliability Requirements (Reference 13) as well as LGS Electrical Power Systems TS Basis 3.8.1:

> “At least two onsite A.C. and their corresponding D.C. power sources and distribution systems providing power for at least two ECCS divisions (1 Core Spray loop, 1 LPCI pump and 1 RHR pump in suppression pool cooling) are required for design basis accident mitigation as discussed in UFSAR Table 6.3-3.”

The analyses use the current ECCS flow values listed in TS for the LPCI and CS systems.

To support the proposed TS ECCS flow rate changes, LGS requested General Electric-Hitachi (GEH) to perform a supplemental LOCA analysis using NRC approved SAFER/PRIME methodology using nominal assumptions (GEH document 006N4699, Reference 14) per the rules of engagement contained in NEDC-30936P at the Limerick 10CFR50.46 LOCA AOR flowrate of 8,000 gpm for a LPCI pump and 5,000 gpm for CS loop for both limiting liquid line breaks (recirculation suction line breaks, RSLB) and the limiting steam line breaks (main steam line breaks inside containment, STML). As documented in this report, this analysis was performed for GNF3 fuel but also bounds the GNF2 response. This analysis supplements the NEDC-30936P-A analysis, and the same realistic analysis methods in NEDC-30936P-A are used. The evaluation used the current state-of-the-art NRC-approved SAFER/PRIME evaluation model (consistent with the current LOCA AOR) in place of the previous NRC approved SAFE/REFLOOD/CHASTE evaluation models used in NEDC-30936P-A. The evaluation performed used the current Limerick SAFER basedeck and plant parameter inputs (OPL-4 input parameters) that were recently used in the GNF3 ECCS-LOCA evaluation for Limerick. Specifically, GEH/GNF performed LOCA break spectrum runs for the cases listed in Table 3-7 of NEDC-30936P-A with either one LPCI pump at 8,000 gpm considering LPCI coupling leakage or one Low Pressure Core Spray (LPCS) loop at 5,000 gpm also considering CS process bypass leakage at 3,515 $MW_t$ reactor power.

The analyzed break spectra include the following scenarios performed using nominal assumptions consistent with NEDC-30936P-A basis:

1) SAFER recirculation suction line break spectrum (from a break size of 0.001 $ft^2$ to double ended guillotine break size (DBA), 4.174 $ft^2$) with one LPCI pump available at 8,000 gpm capacity.

2) SAFER recirculation suction line breaks spectra (from a break size of 0.001 $ft^2$ to DBA break) with one LPCS loop available at 5,000 gpm capacity.

3) SAFER steam break (inside containment) spectra (from a break size of 0.001 $ft^2$ to main steam line break size of 3.05 $ft^2$) with one LPCI pump or one LPCS loop available.

GEH 006N4699 analysis concluded that the limiting PCT for all cases is below the acceptance criteria of 2200˚F for ECCS performance, which is the same acceptance criteria as that specified in Section 3.3.2 of NEDC-30936P-A.

Furthermore, in addition to the margin demonstrated in the GEH 006N4699 analysis, the same report also documents that this analysis retains additional conservatism in the application of the approved methodology that further supports the available margin in the results, and bounding nature of the documented results. Performing a more realistic analysis via removing these additional conservatisms would result in a noticeably lower PCT. They are as follows:

- The SAFER code maintains the inherent approximately 100˚F PCT margin in the simplified model for radiative heat transfer for the RSLB DBA cases as discussed in NEDE-23785P-A (Reference 15).

- The SAFER analysis assumes the hot bundle power is placed on both the LOCA initial Critical Power Ratio (CPR) and the Peak Linear Heat Generation Rate (PLHGR) limits. Generally, it is not likely for a bundle to be at or near both the LHGR and Minimum CPR limits simultaneously. The PCT for the limiting large break LOCA is determined primarily by the hot bundle power. Assuming the hot bundle to be operating at the thermal limits is conservative for PCT calculation.

- The nominal generic decay heat (nominal 1979 ANS 5.1) model is assumed instead of the plant specific decay heat. The nominal generic decay heat is cycle independent and bounds all plant specific decay heats.

**3.5 Typographical Errors**

This LAR corrects two typographical errors:

1) A typographical error in Unit 1 TS 3/4 .8.3.1.8.b will be corrected. The 480-VAC load center identified as “D224 (20B204)” will be revised to “*D244* (20B204).” In Attachment 8, it can be seen that the safeguard 480 load center fed from the D24 4.1 kV emergency bus should be labeled D244 consistent with the labeling nomenclature established for the 480 VAC safeguard load centers.

2) A typographical error in Unit 1 TS 4.8.1.1.2.e.2 will be corrected. The “c)” had been erroneously inserted into the middle of the TS 4.8.1.1.2.e.2.b wording as could be clearly seen in the equivalent Unit 2 TS 4.8.1.1.2.e.2.b, which is correct.

## 4.0 REGULATORY EVALUATION

### 4.1 Applicable Regulatory Requirements/Criteria

LGS was licensed to the 10 CFR 50, Appendix A, General Design Criteria (GDC).
The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met. Exelon has determined that the proposed changes do not require any exemptions or relief from regulatory requirements from the following current applicable regulations and regulatory requirements, which were reviewed in making this determination:

10 CFR 50.36 - Technical specifications

Per 10 CFR 50.36(c)(3) TS includes SRs 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 limiting conditions for operation will be met. The proposed changes involve the frequency and voltage uncertainty acceptance bands for eight EDG SRs. In addition,10 CFR 50.36 requires that a licensee's TS be derived from the analyses and

evaluation included in the safety analysis report. The proposed changes are based on revised analysis and calculations performed consistent with the WCAP-17308 methodology, which has been approved by NRC in a Safety Evaluation Report dated April 17, 2017 (Reference 16). The proposed changes do not affect LGS's compliance with the intent of 10 CFR 50.36.

<u>10 CFR 50.46 - Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors</u>

The regulation at 10 CFR 50.46(a)(1)(i) requires, in part, that nuclear power plants "must be provided with an emergency core cooling system (ECCS) that must be designed so that its calculated cooling performance following postulated loss-of-coolant accidents conforms to the criteria set forth in this section. ECCS cooling performance must be calculated in accordance with an acceptable evaluation model and must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant accidents are calculated.

Comparisons to applicable experimental data must be made and uncertainties in the analysis method and inputs must be identified and assessed so that the uncertainty in the calculated results can be estimated. The proposed changes do not affect LGS's compliance with the intent of 10 CFR 50.46.

<u>General Design Criterion (GDC) 17 - Electric Power Systems</u>

GDC 17 requires an onsite electric power system and an offsite electric power system shall be provided to permit the functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents. The proposed changes do not affect LGS's compliance with the intent of GDC 17.

<u>GDC 18 - Inspection and testing of electrical power systems</u>

GDC 18 requires that electric power systems that are important to safety must be designed to permit appropriate periodic inspection and testing of important areas and features, such as insulation and connections to assess the continuity of the systems and the condition of their components. The proposed changes do not affect LGS's compliance with the intent of GDC 18.

<u>GDC 34 - Residual heat removal</u>

GDC 34 requires that a system to remove residual heat shall be provided. The system safety function shall be to transfer fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded. The GDC requires, in part, that "capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) ... the system safety function can be accomplished,

assuming a single failure." The proposed changes do not affect LGS's compliance with the intent of GDC 34.

GDC 37 - "Testing of Emergency Core Cooling System"

GDC 37 requires that the ECCS shall 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. An additional GEH Analysis has been completed that validates that the proposed ECCS flow acceptance criteria is acceptable to maintain peak cladding temperature within the bounds of the LOCA analysis. The proposed changes do not affect LGS's compliance with the intent of GDC 37.

Regulatory Guide 1.9, Revision 3, July 1993 - Selection, Design, and Qualifications of Diesel Generator Units Used as Standby (Onsite) Electric Power Systems at Nuclear Power Plants

RG 1.9 Revision 3 states, in part, that an emergency diesel generator unit selected for use in an onsite electric power system should have the capability to (1) start and accelerate a number of large motor loads in rapid succession while maintaining voltage and frequency within acceptable limits, (2) provide power promptly to engineered safety features if a loss of offsite power and an accident occur during the same time period, and (3) supply power continuously to the equipment needed to maintain the plant in a safe condition if an extended loss of offsite power occurs. The proposed changes do not affect LGS's compliance with the guidance in RG.1.9. Note: LGS is committed to Regulatory Guide 1.9 (March 1971).

Westinghouse Electric Company LLC Report WCAP-17308-NP-A - "Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances," Revision O (ADAMS Accession No. ML 17215A230).

The design analysis LM-0736 associated with supporting the steady state EDG voltage and frequency TS SR acceptance uncertainties was revised consistent with WCAP-17308-NP-A methodology. Several minor deviations from the methodology were exercised and discussed in the Section 3.0 Technical Evaluation. The deviations were more conservative and do not affect LGS's compliance with the intent of WCAP-17308**.**

## 4.2 Precedent

The following precedent is applicable to this proposed LAR:

Exelon has two similar LARs that have recently been approved:

- Calvert Cliffs Nuclear Power Plant, Units 1 and 2 – Issuance of Amendment Nos. 338 AND 316 Re: Revise Emergency Diesel Generator Surveillance Requirements for Frequency and Voltage Tolerances (EPID L-2019-LLA-0281), dated November 9, 2020 (ADAMS Accession No. ML20273A088)

- Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2 – Issuance of Amendment Nos. 221, 221, 224, and 224, Regarding Technical Specifications 3.8.1, AC Sources - Operating (EPID L-2020-LLA-0141), dated April 2, 2021 (ADAMS Accession No. ML21060B281)

In addition, the following precedent has additional insights from the NRC assessment of impact on the ECCS flow rates:

- Susquehanna Steam Electric Station, Units 1 and 2 – Issuance of Amendments Re: Diesel Generator Surveillance Requirements with new Steady-State Voltage and Frequency Limits (CAC Nos. MF9131 and MF9132; EPID L-2017-LLA-0180), dated January 22, 2018 (ADAMS Accession No. ML17352A711)

  Based on its review, the NRC documented in its safety evaluation report that the staff had determined that the information provided reasonable assurance that the impact on ECCS flow rates as a result of the ECCS flow rate estimate analysis was bounded by the conservatisms in the AREVA Appendix K evaluation model. The NRC staff also found that the non-limiting LOCA cases would remain non-limiting, and the voltage and frequency limits in the proposed TS SRs would not adversely affect the ECCS flow rates used in the LOCA analysis. Therefore, the NRC staff concluded that the AOR remains acceptable. Note: Susquehanna did not revise IST curves.

### 4.3 No Significant Hazards Consideration

Pursuant to 10 CFR 50.90, “Application for amendment of license or construction permit,” Exelon Generation Company, LLC (Exelon), proposes changes to the Technical Specifications (TS), Appendix A of Operating License Nos. NPF-39 and NPF-85 for Limerick Generating Station (LGS), Units 1 and 2, respectively. The proposed amendments would revise eight frequency and voltage acceptance criteria for steady-state emergency diesel generator (EDG) surveillance requirements (SRs) under TS 3/4.8.1, "A.C. Sources - Operating.” The proposed changes are consistent with WCAP-17308-NP-A, Rev 0, “Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances,” dated July 2017.

Specifically, the proposed change revises the acceptable steady-state frequency uncertainty tolerance from “60 Hz ± 1.2 Hz” to “59.8-60.8 Hz” for eight applicable EDG SRs. The voltage uncertainty tolerance is rewritten for clarification (no voltage change) from “4280 ± 120 volts” to “≥ 4160 V and ≤ 4400 V.” The tighter SR EDG steady-state frequency uncertainty acceptance tolerance will improve design margins for the EDG safety related loads.

In addition, to address the non-conservative TS and to gain additional margin at the proposed EDG frequency and voltage steady state frequency tolerances, the Emergency Core Cooling Systems core spray system (CSS) and Low Pressure Coolant Injection (LPCI) Pumps will have their TS SR flow acceptance criteria revised from 3,175 and 10,000 gpm to 2,500 and 8,000 gpm, respectively.

Also, unrelated to WCAP-17308 methodology implementation, two Unit 1 TS typographical errors, which are administrative in nature, will be corrected. In Unit 1 TS 3/4 8.3.1.8.b, the 480-

VAC load center identified as “D224 (20B204)” will be revised to “D244 (20B204).” In Unit 1 TS 4.8.1.1.2.e.2 will be corrected. The “c)” had been erroneously inserted into the middle of the TS 4.8.1.1.2.e.2.b and will be deleted.

The proposed amendments are required to correct a non-conservative TS. Plant operations are currently administratively controlled, and no safety concerns currently exist regarding EDG voltage or frequency steady-state uncertainty values. Plant operations are currently administratively controlled as described in Regulatory Guide 1.239, “Licensee Actions to Address Nonconservative Technical Specifications,” which endorses NEI 15-03, “Licensee Actions to Address Nonconservative Technical Specifications.” In accordance with the guidance in NEI 15-03, the proposed amendments are required to resolve a non-conservative TS and are not a voluntary request to change the LGS licensing basis.

Exelon has evaluated whether or not a significant hazards consideration is involved with the proposed amendments for LGS, by focusing on the three standards set forth in 10 CFR 50.92(c), "Issuance of amendment," as discussed below:

**1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?**

Response: No.

The EDGs and ECCS pumps are not initiators for any accidents evaluated in the Updated Final Safety Analysis Report (UFSAR). The proposed changes provide a more conservative range of acceptable EDG frequency values for certain TS SRs. Revising the ECCS pump flow acceptance criteria within the boundaries of the Loss-of-Coolant Accident (LOCA) Analysis of Record (AOR) does not affect ECCS pump operation and does not affect the ability of the ECCS pumps to perform their design function. Thus, TS SRs will continue to demonstrate sufficient margin such that mitigation of accidents evaluated in the UFSAR is not impacted. The proposed changes do not alter the design function of the EDGs or ECCS pumps, nor do they affect how the EDGs or ECCS pumps are operated or physically tested.

Therefore, the proposed changes do not involve an increase in the probability or consequences of an accident previously evaluated.

**2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?**

Response: No.

The proposed changes do not involve any physical alterations and no new or different types of equipment are being installed. Requiring a more conservative range of acceptable EDG frequency SR acceptance values and revising the ECCS pump flow acceptance criteria within the boundaries of the Loss-of-Coolant Accident (LOCA) Analysis of Record (AOR) does not affect EDG and ECCS pump operation and does not affect the ability of the EDGs and ECCS pumps to perform their design function. There are no new credible failure mechanisms, malfunctions, or accident initiators introduced as a result of the proposed changes.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

**3. Does the proposed change involve a significant reduction in a margin of safety?**

Response: No.

Since the proposed changes provide a more conservative range of acceptable EDG frequency values, the margin of safety is maintained. The new ECCS flow acceptance criteria has been analyzed and is within the boundaries of the LOCA AOR with acceptable margin. Where required, TS SR acceptance criteria have been procedurally adjusted to ensure equipment performance meets accident analysis assumptions considering uncertainties in steady-state operation of EDGs for frequency. Exelon has evaluated the effects of EDG frequency variations on affected equipment, and in particular for ECCS pumps, and confirmed that the design basis analyses are not adversely affected.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on the above, Exelon concludes that the proposed amendments do not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

### 4.4 Conclusions

There are no changes being proposed in this amendment application such that commitments to the regulatory requirements and guidance documents above would come into question. The evaluations documented above confirm that LGS will continue to comply with all applicable regulatory requirements.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) 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.

## 5.0 ENVIRONMENTAL CONSIDERATION

The proposed changes would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed changes.

## 6.0 REFERENCES


1. Exelon LM-0736, Revision 1, "Analyses of Emergency Diesel Generator Technical Specification Voltage and Frequency Range and Tolerances"

2. WCAP-17308-NP-A, Rev 0, "Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances," dated July 2017

3. Regulatory Guide 1.9 (March 1971) - Selection of Diesel Generator Set Capacity for Standby Power Supplies (Safety Guide 9)

4. Exelon Calculation 6380E.07, Revision 15D, "Diesel Generator Loading (Steady State)"

5. Exelon 6300E.18, Revision 27E, "Perform a Load Study for the Aux Power System"

6. Email: Daren Crotteau, Fairbanks Morse, Manager Nuclear Parts, Services and Solutions to Greg Curtin, Exelon Nuclear, Re: Long Term Steady State EDG Operation @ 58.8 Hz or 61.2 Hz Inquiry, dated July 13, 2020.

7. Exelon 6300E.23, Revision 12, Millstone Undervoltage Study

8. GE-Hitachi Nuclear Energy, 0000-0111-9078-R0, "Limerick Generating Station Units 1 and 2 GNF2 ECCS-LOCA Evaluation," February 2011.

9. GE-Hitachi Nuclear Energy, 005n3990, "Limerick Generating Station Units 1 and 2 GNF3 ECCS-LOCA Evaluation, December 2020

10. NEDO-33173, Supplement 4-A, Revision 1, GE Hitachi Nuclear Energy, "Implementation of PRIME Models and Data in Downstream Methods," November 2012

11. NEDO-24708A, Revision 1 General Electric Company, "Additional Information Required for NRC Staff Generic Report on Boiling Water Reactors," December 1980

12. NEDC-30936P-A, General Electric Company, "BWR Owner's Group Technical Specification Improvement Methodology (with Demonstration for BWR ECCS Activation Instrumentation)," December 1988

13. UFSAR Chapter 6.3, Emergency Core Cooling Systems, Section 6.3.1.1.2.o (Reliability Requirements)

14. GEH Nuclear Energy 006N4699 Revision B, "Limerick Supplemental ECCS Flow Reduction LOCA Analysis for NEDC-30936," May 2021

15. NEDE-23785-1 PA, Rev. 1, General Electric Company, "The GESTR-LOCA and SAFER models for the evaluation of the Loss-of-Coolant Accident, Volume III, SAFER/GESTR Application Methodology," Oct 1984

16. Letter from K. Hsueh (U.S. Nuclear Regulatory Commission) to W. A. Nowinowski (Westinghouse Electric Company), "Final Safety Evaluation for Pressurized Water Reactor Owners Group Topical Report WCAP-17308-NP, Revision 0, 'Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances' (TAC No. ME8689)," dated April 17, 2017.

**ATTACHMENT 2**

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**Markup of Proposed Technical Specifications Pages**

**Unit 1 TS Pages**

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3/4 8-3
3/4 8-4
3/4 8-5
3/4 8-6
3/4 8-7a
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**Unit 2 TS Pages**

3/4 5-4
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3/4 8-5
3/4 8-6
3/4 8-7a

EMERGENCY CORE COOLING SYSTEMS

SURVEILLANCE REQUIREMENTS

4.5.1 The emergency core cooling systems shall be demonstrated OPERABLE by:

a. In accordance with the Surveillance Frequency Control Program:

1. For the CSS, the LPCI system, and the HPCI system:

a) Verifying locations susceptible to gas accumulation are sufficiently filled with water.

b) Verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct* position.***

2. For the LPCI system, verifying that both LPCI system subsystem cross-tie valves (HV-51-182 A, B) are closed with power removed from the valve operators.

3. For the HPCI system, verifying that the HPCI pump flow controller is in the correct position.

4. For the CSS and LPCI system, performance of a CHANNEL FUNCTIONAL TEST of the injection header ΔP instrumentation.

b. Verifying that, when tested pursuant to Specification 4.0.5:

1. Each CSS pump in each subsystem develops a flow of at least 3175 [2500] gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of ≥ 105 psid plus head and line losses.

2. Each LPCI pump in each subsystem develops a flow of at least 10,000 [8000] gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of ≥ 20 psid plus head and line losses.

3. The HPCI pump develops a flow of at least 5600 gpm against a test line pressure which corresponds to a reactor vessel pressure of 1040 psig plus head and line losses when steam is being supplied to the turbine at 1040, +13, -120 psig.**

c. In accordance with the Surveillance Frequency Control Program:

1. For the CSS, the LPCI system, and the HPCI system, performing a system functional test which includes simulated automatic actuation of the system throughout its emergency operating sequence and verifying that each automatic valve in the flow path actuates to its correct position. Actual injection of coolant into the reactor vessel may be excluded from this test.

* Except that an automatic valve capable of automatic return to its ECCS position when an ECCS signal is present may be in position for another mode of operation.

** The provisions of Specification 4.0.4 are not applicable provided the surveillance is performed within 12 hours after reactor steam pressure is adequate to perform the test. If OPERABILITY is not successfully demonstrated within the 12-hour period, reduce reactor steam dome pressure to less than 200 psig within the following 72 hours.

*** Not required to be met for system vent flow paths opened under administrative control.

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each of the above required independent circuits between the offsite transmission network and the onsite Class 1E distribution system shall be:

a. Determined OPERABLE in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignments and indicated power availability, and

b. Demonstrated OPERABLE in accordance with the Surveillance Frequency Control Program by transferring, manually and automatically, unit power supply from the normal circuit to the alternate circuit.

4.8.1.1.2 Each of the above required diesel generators shall be demonstrated OPERABLE:

a. In accordance with the Surveillance Frequency Control Program on a STAGGERED TEST BASIS by:

1. Verifying the fuel level in the day fuel tank.

2. Verifying the fuel level in the fuel storage tank.

3. Verifying the fuel transfer pump starts and transfers fuel from the storage system to the day fuel tank.

4. Verify that the diesel can start* and gradually accelerate to synchronous speed with generator voltage and frequency at 4280 ± 120 volts and 60 ± 1.2 HZ.

steady-state generator voltage ≥ 4160 V and ≤ 4400 V and frequency ≥ 59.8Hz and ≤ 60.8 Hz.

5. Verify diesel is synchronized, gradually loaded* to an indicated 2700-2800 KW** and operates with this load for at least 60 minutes.

6. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.

7. Verifying the pressure in all diesel generator air start receivers to be greater than or equal to 225 psig.

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*This test shall be conducted in accordance with the manufacturer's recommendations regarding engine pre-lube and warmup procedures, and as applicable regarding loading and shutdown recommendations.

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

b. By removing accumulated water:

1) From the day tank in accordance with the Surveillance Frequency Control Program and after each occasion when the diesel is operated for greater than 1 hour, and

2) From the storage tank in accordance with the Surveillance Frequency Control Program.

c. By sampling new fuel oil in accordance with ASTM D4057-81 prior to addition to the storage tanks and:

1) By verifying in accordance with the tests specified in ASTM D975-81 prior to addition to the storage tanks that the sample has:

a) An API Gravity of within 0.3 degrees at 60°F or a specific gravity of within 0.0016 at 60/60°F, when compared to the supplier's certificate or an absolute specific gravity at 60/60°F of greater than or equal to 0.83 but less than or equal to 0.89 or an API gravity at 60°F of greater than or equal to 27 degrees but less than or equal to 39 degrees.

b) A kinematic viscosity at 40°C of greater than or equal to 1.9 centistokes, but less than or equal to 4.1 centistokes, if gravity was not determined by comparison with the supplier's certification.

c) A flash point equal to or greater than 125°F, and

d) A clear and bright appearance with proper color when tested in accordance with ASTM D4176-82.

2) By verifying within 31 days of obtaining the sample that the other properties specified in Table 1 of ASTM D975-81 are met when tested in accordance with ASTM D975-81 except that the analysis for sulfur may be performed in accordance with ASTM D1552-79 or ASTM D2622-82.

d. In accordance with the Surveillance Frequency Control Program by obtaining a sample of fuel oil from the storage tanks in accordance with ASTM D2276-78, and verifying that total particulate contamination is less than 10 mg/liter when checked in accordance with ASTM D2276-78, Method A, except that the filters specified in ASTM D2276-78, Sections 5.1.6 and 5.1.7, may have a nominal pore size of up to three (3) microns.

e. In accordance with the Surveillance Frequency Control Program by:

1. Deleted

2. Verifying each diesel generator's capability to reject a load of greater than or equal to that of its single largest post-accident load, and:

a) Following load rejection, the frequency is ≤ 66.5 Hz;

Delete Typo.

b) c) Within 1.8 seconds following the load rejection, voltage is 4285 ± 420 volts, and frequency is 60 ± 1.2 Hz; and

the voltage is ≥ 3865 V and ≤ 4705 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and

c) After steady-state conditions are reached, voltage is maintained at 4280 ± 120 volts.

≥ 4160 V and ≤ 4400 V and frequency ≥ 59.8Hz and ≤ 60.8 Hz.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

3. Verifying the diesel generator capability to reject a load of 2850 kW without tripping. The generator voltage shall not exceed 4784 volts during and following the load rejection.

4. Simulating a loss-of-offsite power by itself, and:

a) Verifying deenergization of the emergency busses and load shedding from the emergency busses.

b) Verifying the diesel generator starts* on the auto-start signal, energizes the emergency busses within 10 seconds, energizes the auto-connected loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the shutdown loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained at 4280 ± 120 volts and 60 ± 1.2 Hz during this test.

is ≥ 4160 V and ≤ 4400 V and ≥ 59.8 Hz and ≤ 60.8 Hz during the test.

5. Verifying that on an ECCS actuation test signal, without loss-of-offsite power, the diesel generator starts* on the auto-start signal and operates on standby for greater than or equal to 5 minutes. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the auto-start signal; the steady state generator voltage and frequency shall be maintained within these limits during this test.

The generator voltage and frequency shall reach ≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz within 10 seconds after auto-start signal; the steady state generator voltage and frequency shall be maintained ≥ 4160 V and ≤ 4400 V and ≥ 59.8Hz and ≤ 60.8 Hz during this test.

6. Simulating a loss-of-offsite power in conjunction with an ECCS actuation test signal, and:

a) Verifying deenergization of the emergency busses and load shedding from the emergency busses.

b) Verifying the diesel generator starts* on the auto-start signal, energizes the emergency busses within 10 seconds, energizes the auto-connected shutdown loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the emergency loads. After energization, the steady-state voltage and frequency of the emergency busses shall be maintained at 4280 ± 120 volts and 60 ± 1.2 Hz during this test.

≥ 4160 V and ≤ 4400 V and ≥ 59.8Hz and ≤ 60.8 Hz

7. Verifying that all automatic diesel generator trips, except engine overspeed and generator differential over-current are automatically bypassed upon an ECCS actuation signal.

* This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warm-up procedures, and as applicable regarding loading and shutdown recommendations.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

8. a) Verifying the diesel generator operates* for at least 24 hours. During the first 2 hours of this test, the diesel generator shall be loaded to an indicated 2950-3050 kW** and during the remaining 22 hours of this test, the diesel generator shall be loaded to an indicated 2700-2800 kW**.

b) Verifying that, within 5 minutes of shutting down the diesel generator after the diesel generator has operated* for at least 2 hours at an indicated 2700-2800 kW**, the diesel generator starts*. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the start signal.

≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz within 10 seconds after the start signal.

After steady-state conditions are reached, voltage is maintained ≥ 4160 V and ≤ 4400 V and frequency is maintained ≥ 59.8 Hz and ≤ 60.8 Hz.

9. Verifying that the auto-connected loads to each diesel generator do not exceed the 2000-hour rating of 3100 kW.

10. Verifying the diesel generator's capability to:

a) Synchronize with the offsite power source while the generator is loaded with its emergency loads upon a simulated restoration of offsite power,

b) Transfer its loads to the offsite power source, and

c) Be restored to its standby status.

11. Verifying that with the diesel generator operating in a test mode and connected to its bus, a simulated ECCS actuation signal overrides the test mode by (1) returning the diesel generator to standby operation, and (2) automatically energizes the emergency loads with offsite power.

12. Verifying that the automatic load sequence timers are OPERABLE with the interval between each load block within ± 10% of its design interval.

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* This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warmup procedures, and as applicable regarding loading and shutdown recommendations.

** This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

h. In accordance with the Surveillance Frequency Control Program the diesel generator shall be started* and verified to accelerate to synchronous speed in less than or equal to 10 seconds. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the start signal. The diesel generator shall be started for this test by using one of the following signals:

≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz

After steady-state conditions are reached, voltage is maintained ≥ 4160 V and ≤ 4400 V and frequency is maintained ≥ 59.8Hz and ≤ 60.8 Hz.

a) Manual***

b) Simulated loss-of-offsite power by itself.

c) Simulated loss-of-offsite power in conjunction with an ECCS actuation test signal.

d) An ECCS actuation test signal by itself.

The generator shall be manually synchronized to its appropriate emergency bus, loaded to an indicated 2700-2800 KW** and operate for at least 60 minutes. This test, if it is performed so it coincides with the testing required by Surveillance Requirement 4.8.1.1.2.a.4 and 4.8.1.1.2.a.5, may also serve to concurrently meet those requirements as well.

4.8.1.1.3 Deleted

*This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warmup procedures, and as applicable regarding loading and shutdown recommendations.

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

***If diesel generator started manually from the control room, 10 seconds after the automatic prelube period.

LIMITING CONDITION FOR OPERATION (Continued)

| | | | |
|---|---|---|---|
| c) | 480-VAC Motor Control Centers: | D144-R-G | (10B222) |
| | | D144-R-H | (10B218) |
| | | D144-R-E | (10B224) |
| | | D144-C-B | (00B132) |
| | | D144-D-G | (10B518) |
| d) | 120-VAC Distribution Panels: | 10Y104 | |
| | | 10Y164 | |

5. Unit 2 and Common Division 1, Consisting of:

| | | | |
|---|---|---|---|
| a) | 4160-VAC bus: | D21 | (20A115) |
| b) | 480-VAC load center: | D214 | (20B201) |
| c) | 480-VAC motor control centers: | D114-S-L | (00B519) |
| | | D214-R-C | (20B213) |
| | | D214-D-G | (20B515) |
| d) | 120-VAC distribution panels: | 01Y501 | |
| | | 20Y101 | |
| | | 20Y206 | |

6. Unit 2 and Common Division 2, Consisting of:

| | | | |
|---|---|---|---|
| a) | 4160-VAC bus: | D22 | (20A116) |
| b) | 480-VAC load center: | D224 | (20B202) |
| c) | 480-VAC motor control centers: | D124-S-L | (00B520) |
| | | D224-D-G | (20B516) |
| d) | 120-VAC distribution panels: | 02Y501 | |
| | | 20Y102 | |
| | | 20Y207 | |

7. Unit 2 and Common Division 3, Consisting of:

| | | | |
|---|---|---|---|
| a) | 4160-VAC bus: | D23 | (20A117) |
| b) | 480-VAC load center: | D234 | (20B203) |
| c) | 480-VAC motor control centers: | D234-S-L | (00B521) |
| | | D234-D-G | (20B517) |
| d) | 120-VAC distribution panels: | 03Y501 | |
| | | 20Y103 | |
| | | 20Y163 | |

8. Unit 2 and Common Division 4, Consisting of:

| | | | |
|---|---|---|---|
| a) | 4160-VAC bus: | D24 | (20A118) |
| b) | 480-VAC load center: | ~~D224~~ D244 | (20B204) |
| c) | 480-VAC motor control centers: | D244-S-L | (00B522) |
| | | D244-D-G | (20B518) |
| d) | 120-VAC distribution panels: | 04Y501 | |
| | | 20Y104 | |
| | | 20Y164 | |

SURVEILLANCE REQUIREMENTS

4.5.1 The emergency core cooling systems shall be demonstrated OPERABLE by:

a. In accordance with the Surveillance Frequency Control Program:

1. For the CSS, the LPCI system, and the HPCI system:

a) Verifying locations susceptible to gas accumulation are sufficiently filled with water.

b) Verifying that each valve (manual, power-operated, or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct* position.***

2. For the LPCI system, verifying that both LPCI system subsystem cross-tie valves (HV-51-282 A, B) are closed with power removed from the valve operators.

3. For the HPCI system, verifying that the HPCI pump flow controller is in the correct position.

4. For the CSS and LPCI system, performance of a CHANNEL FUNCTIONAL TEST of the injection header ΔP instrumentation.

b. Verifying that, when tested pursuant to Specification 4.0.5:

1. Each CSS pump in each subsystem develops a flow of at least 3175 [2500] gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of = 105 psid plus head and line losses.

2. Each LPCI pump in each subsystem develops a flow of at least 10,000 [8000] gpm against a test line pressure corresponding to a reactor vessel to primary containment differential pressure of ≥ 20 psid plus head and line losses.

3. The HPCI pump develops a flow of at least 5600 gpm against a test line pressure which corresponds to a reactor vessel pressure of 1040 psig plus head and line losses when steam is being supplied to the turbine at 1040, +13, -120 psig.**

c. In accordance with the Surveillance Frequency Control Program:

1. For the CSS, the LPCI system, and the HPCI system, performing a system functional test which includes simulated automatic actuation of the system throughout its emergency operating sequence and verifying that each automatic valve in the flow path actuates to its correct position. Actual injection of coolant into the reactor vessel may be excluded from this test.

* Except that an automatic valve capable of automatic return to its ECCS position when an ECCS signal is present may be in position for another mode of operation.

** The provisions of Specification 4.0.4 are not applicable provided the surveillance is performed within 12 hours after reactor steam pressure is adequate to perform the test. If OPERABILITY is not successfully demonstrated within the 12-hour period, reduce reactor steam dome pressure to less than 200 psig within the following 72-hours.

*** Not required to be met for system vent flow paths opened under administrative control.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each of the above required independent circuits between the offsite transmission network and the onsite Class 1E distribution system shall be:

a. Determined OPERABLE in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignments and indicated power availability, and

b. Demonstrated OPERABLE in accordance with the Surveillance Frequency Control Program by transferring, manually and automatically, unit power supply from the normal circuit to the alternate circuit.

4.8.1.1.2 Each of the above required diesel generators shall be demonstrated OPERABLE:

a. In accordance with the Surveillance Frequency Control Program on a STAGGERED TEST BASIS by:

1. Verifying the fuel level in the day fuel tank.

2. Verifying the fuel level in the fuel storage tank.

3. Verifying the fuel transfer pump starts and transfers fuel from the storage system to the day fuel tank.

4. Verify that the diesel can start* and gradually accelerate to synchronous speed with generator voltage and frequency at 4280 ± 120 volts and 60 ± 1.2 Hz.

steady-state generator voltage ≥ 4160 V and ≤ 4400 V and frequency ≥ 59.8Hz and ≤ 60.8 Hz.

5. Verify diesel is synchronized, gradually loaded* to an indicated 2700-2800 kW** and operates with this load for at least 60 minutes.

6. Verifying the diesel generator is aligned to provide standby power to the associated emergency busses.

7. Verifying the pressure in all diesel generator air start receivers to be greater than or equal to 225 psig.

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*This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warmup procedures, and as applicable regarding loading and shutdown recommendations.

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

b. By removing accumulated water:

1) From the day tank in accordance with the Surveillance Frequency Control Program and after each occasion when the diesel is operated for greater than 1 hour, and

2) From the storage tank in accordance with the Surveillance Frequency Control Program.

c. By sampling new fuel oil in accordance with ASTM D4057-81 prior to addition to the storage tanks and:

1) By verifying in accordance with the tests specified in ASTM D975-81 prior to addition to the storage tanks that the sample has:

a) An API Gravity of within 0.3 degrees at 60°F or a specific gravity of within 0.0016 at 60/60°F, when compared to the supplier's certificate or an absolute specific gravity at 60/60°F of greater than or equal to 0.83 but less than or equal to 0.89 or an API gravity at 60°F of greater than or equal to 27 degrees but less than or equal to 39 degrees.

b) A kinematic viscosity at 40°C of greater than or equal to 1.9 centistokes, but less than or equal to 4.1 centistokes, if gravity was not determined by comparison with the supplier's certification.

c) A flash point equal to or greater than 125°F, and

d) A clear and bright appearance with proper color when tested in accordance with ASTM D4176-82.

2) By verifying within 31 days of obtaining the sample that the other properties specified in Table 1 of ASTM D975-81 are met when tested in accordance with ASTM D975-81 except that the analysis for sulfur may be performed in accordance with ASTM D1552-79 or ASTM D2622-82.

d. In accordance with the Surveillance Frequency Control Program by obtaining a sample of fuel oil from the storage tanks in accordance with ASTM D2276-78, and verifying that total particulate contamination is less than 10 mg/liter when checked in accordance with ASTM D2276-78, Method A, except that the filters specified in ASTM D2276-78, Sections 5.1.6 and 5.1.7, may have a nominal pore size of up to three (3) microns.

e. In accordance with the Surveillance Frequency Control Program by:

1) Deleted

2) Verifying each diesel generator's capability to reject a load of greater than or equal to that of its single largest post-accident load, and:

a) Following load rejection, the frequency is ≤ 66.5 Hz;

b) Within 1.8 seconds following the load rejection, voltage is 4285 ± 420 volts, and frequency is 60 ± 1.2 Hz; and

[Markup: the voltage is ≥ 3865 V and ≤ 4705 V, and frequency ≥ 58.8 Hz and ≤ 61.2 Hz; and]

c) After steady-state conditions are reached, voltage is maintained at 4280 ± 120 volts.

[Markup: ≥ 4160 V and ≤ 4400 V and frequency ≥ 59.8Hz and ≤ 60.8 Hz.]

SURVEILLANCE REQUIREMENTS (Continued)

3. Verifying the diesel generator capability to reject a load of 2850 kW without tripping. The generator voltage shall not exceed 4784 volts during and following the load rejection.

4. Simulating a loss-of-offsite power by itself, and:

   a) Verifying deenergization of the emergency buses and load shedding from the emergency buses.

   b) Verifying the diesel generator starts* on the auto-start signal, energizes the emergency buses within 10 seconds, energizes the auto-connected loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the shutdown loads. After energization, the steady-state voltage and frequency of the emergency buses shall be maintained at 4280 ± 120 volts and 60 ± 1.2 Hz during this test.

   is ≥ 4160 V and ≤ 4400 V and ≥ 59.8 Hz and ≤ 60.8 Hz during the test.

5. Verifying that on an ECCS actuation test signal, without loss-of-offsite power, the diesel generator starts* on the auto-start signal and operates on standby for greater than or equal to 5 minutes. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the auto-start signal; the steady state generator voltage and frequency shall be maintained within these limits during this test.

   The generator voltage and frequency shall reach ≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz within 10 seconds after auto-start signal; the steady state generator voltage and frequency shall be maintained ≥ 4160 V and ≤ 4400 V and ≥ 59.8Hz and ≤ 60.8 Hz during this test.

6. Simulating a loss-of-offsite power in conjunction with an ECCS actuation test signal, and:

   a) Verifying deenergization of the emergency buses and load shedding from the emergency buses.

   b) Verifying the diesel generator starts* on the auto-start signal, energizes the emergency buses within 10 seconds, energizes the auto-connected shutdown loads through the individual load timers and operates for greater than or equal to 5 minutes while its generator is loaded with the emergency loads. After energization, the steady-state voltage and frequency of the emergency buses shall be maintained at 4280 ± 120 volts and 60 ± 1.2 Hz during this test.

   ≥ 4160 V and ≤ 4400 V and ≥ 59.8Hz and ≤ 60.8 Hz

7. Verifying that all automatic diesel generator trips, except engine overspeed and generator differential over-current are automatically bypassed upon an ECCS actuation signal.

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*This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warm up procedures, and as applicable regarding loading and shutdown recommendations.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

8. a) Verifying the diesel generator operates* for at least 24 hours. During the first 2 hours of this test, the diesel generator shall be loaded to an indicated 2950-3050 kW** and during the remaining 22 hours of this test, the diesel generator shall be loaded to an indicated 2700-2800 kW**.

   b) Verifying that, within 5 minutes of shutting down the diesel generator after the diesel generator has operated* for at least 2 hours at an indicated 2700-2800 kW**, the diesel generator starts*. The generator voltage and frequency shall reach ~~4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the start signal.~~

≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz within 10 seconds after the start signal.

After steady-state conditions are reached, voltage is maintained ≥ 4160 V and ≤ 4400 V and frequency is maintained ≥ 59.8 Hz and ≤ 60.8 Hz.

9. Verifying that the auto-connected loads to each diesel generator do not exceed the 2000-hour rating of 3100 kW.

10. Verifying the diesel generator's capability to:

   a) Synchronize with the offsite power source while the generator is loaded with its emergency loads upon a simulated restoration of offsite power,

   b) Transfer its loads to the offsite power source, and

   c) Be restored to its standby status.

11. Verifying that with the diesel generator operating in a test mode and connected to its bus, a simulated ECCS actuation signal overrides the test mode by (1) returning the diesel generator to standby operation, and (2) automatically energizes the emergency loads with offsite power.

12. Verifying that the automatic load sequence timers are OPERABLE with the interval between each load block within ± 10% of its design interval.

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* This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warmup procedures, and as applicable regarding loading and shutdown recommendations.

** This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

SURVEILLANCE REQUIREMENTS (Continued)

After steady-state conditions are reached, voltage is maintained ≥ 4160 V and ≤ 4400 V and frequency is maintained ≥ 59.8Hz and ≤ 60.8 Hz.

h. In accordance with the Surveillance Frequency Control Program the diesel generator shall be started* and verified to accelerate to synchronous speed in less than or equal to 10 seconds. The generator voltage and frequency shall reach 4280 ± 120 volts and 60 ± 1.2 Hz within 10 seconds after the start signal. The diesel generator shall be started for this test by using one of the following signals:

≥ 4160 V and ≤ 4400 V and ≥ 58.8 Hz and ≤ 61.2 Hz

a) Manual***

b) Simulated loss-of-offsite power by itself.

c) Simulated loss-of-offsite power in conjunction with an ECCS actuation test signal.

d) An ECCS actuation test signal by itself.

The generator shall be manually synchronized to its appropriate emergency bus, loaded to an indicated 2700-2800 KW** and operate for at least 60 minutes. This test, if it is performed so it coincides with the testing required by Surveillance Requirement 4.8.1.1.2.a.4 and 4.8.1.1.2.a.5, may also serve to concurrently meet those requirements as well.

4.8.1.1.3 Deleted

*This test shall be conducted in accordance with the manufacturer's recommendations regarding engine prelube and warmup procedures, and as applicable regarding loading and shutdown recommendations.

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band for special testing under direct monitoring by the manufacturer or momentary variations due to changing bus loads shall not invalidate the test.

***If diesel generator started manually from the control room, 10 seconds after the automatic prelube period.

# ATTACHMENT 3

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**<u>Markup of Proposed Technical Specification Bases Pages</u>**
**<u>(for information only)</u>**

**<u>Unit 1 TS Pages</u>**

B 3/4 5-1

**<u>Unit 2 TS Pages</u>**

B 3/4 5-1

3/4.5.1 ECCS - OPERATING

The core spray system (CSS), together with the LPCI mode of the RHR system, is provided to assure that the core is adequately cooled following a loss-of-coolant accident and provides adequate core cooling capacity for all break sizes up to and including the double-ended reactor recirculation line break, and for smaller breaks following depressurization by the ADS. Management of gas voids is important to ECCS injection/spray subsystem OPERABILITY.

The CSS is a primary source of emergency core cooling after the reactor vessel is depressurized and a source for flooding of the core in case of accidental draining.

The surveillance requirements provide adequate assurance that the CSS will be OPERABLE when required. Although all active components are testable and full flow can be demonstrated by recirculation through a test loop during reactor operation, a complete functional test requires reactor shutdown.

The low pressure coolant injection (LPCI) mode of the RHR system is provided to assure that the core is adequately cooled following a loss-of-coolant accident. Four subsystems, each with one pump, provide adequate core flooding for all break si(2500 and zes up to and including the double-ended reactor recirculation line break, and for small breaks following depressurization by the ADS.

The surveillance requirements provide adequate assurance that the LPCI system will be OPERABLE when required. Although all active components are testable and full flow can be demonstrated by recirculation through a test loop during reactor operation, a complete functional test requires reactor shutdown.

The high pressure coolant injection (HPCI) system is provided to assure that the reactor core is adequately cooled to limit fuel clad temperature in the event of a small break in the reactor coolant system and loss of coolant which does not result in rapid depressurization of the reactor vessel. The HPCI system permits the reactor to be shut down while maintaining sufficient reactor vessel water level inventory until the vessel is depressurized. The HCPI system continues to operate until reactor vessel pressure is below the pressure at which CSS operation or LPCI mode of the RHR system operation maintains core cooling.

The capacity of the system is selected to provide the required core cooling. The HPCI pump is designed to deliver greater than or equal to 5600 gpm at reactor pressures between 1182 and 200 psig and is capable of delivering at least 5000 gpm between 1182 and 1205 psig. In the system's normal alignment, water from the

The CCS pump flow of 3,175 gpm and the LPCI pump flow of 10,000 gpm are flow values at nominal grid frequency of 60 Hz. The 10CFR50.46 LOCA Analysis of Record (AOR) uses 80% of the prescribed TS SR flow values (2,500 and 8,000 respectively). The calculated TS SR flow rates at the reduced Emergency Diesel Generator minimum steady-state voltage of 4,160 V and 59.8 Hz, when off site power is not available, demonstrate that the ECCS flow rates used in the LOCA analysis are bounding and satisfy SRs 4.5.1.b.1 and 4.5.1.b.2 .

## 3/4.5.1 ECCS - OPERATING

The core spray system (CSS), together with the LPCI mode of the RHR system, is provided to assure that the core is adequately cooled following a loss-of-coolant accident and provides adequate core cooling capacity for all break sizes up to and including the double-ended reactor recirculation line break, and for smaller breaks following depressurization by the ADS. Management of gas voids is important to ECCS injection/spray subsystem OPERABILITY.

The CSS is a primary source of emergency core cooling after the reactor vessel is depressurized and a source for flooding of the core in case of accidental draining.

The surveillance requirements provide adequate assurance that the CSS will be OPERABLE when required. Although all active components are testable and full flow can be demonstrated by recirculation through a test loop during reactor operation, a complete functional test requires reactor shutdown.

The low pressure coolant injection (LPCI) mode of the RHR system is provided to assure that the core is adequately cooled following a loss-of-coolant accident. Four subsystems, each with one pump, provide adequate core flooding for all break sizes up to and including the double-ended reactor recirculation line break, and for small breaks following depressurization by the ADS.

The surveillance requirements provide adequate assurance that the LPCI system will be OPERABLE when required. Although all active components are testable and full flow can be demonstrated by recirculation through a test loop during reactor operation, a complete functional test requires reactor shutdown.

The high pressure coolant injection (HPCI) system is provided to assure that the reactor core is adequately cooled to limit fuel clad temperature in the event of a small break in the reactor coolant system and loss of coolant which does not result in rapid depressurization of the reactor vessel. The HPCI system permits the reactor to be shut down while maintaining sufficient reactor vessel water level inventory until the vessel is depressurized. The HCPI system continues to operate until reactor vessel pressure is below the pressure at which CSS operation or LPCI mode of the RHR system operation maintains core cooling.

The capacity of the system is selected to provide the required core cooling. The HPCI pump is designed to deliver greater than or equal to 5600 gpm at reactor pressures between 1182 and 200 psig and is capable of delivering at least 5000 gpm between 1182 and 1205 psig. In the system's normal alignment, water from the con
poo
the

The CCS pump flow of 3,175 gpm and the LPCI pump flow of 10,000 gpm are flow values at nominal grid frequency of 60 Hz. The 10CFR50.46 LOCA Analysis of Record (AOR) uses 80% of the prescribed TS SR flow values (2,500 and 8,000 respectively). The calculated TS SR flow rates at the reduced Emergency Diesel Generator minimum steady-state voltage of 4,160 V and 59.8 Hz, when off site power is not available, demonstrate that the ECCS flow rates used in the LOCA analysis are bounding and satisfy SRs 4.5.1.b.1 and 4.5.1.b.2 .

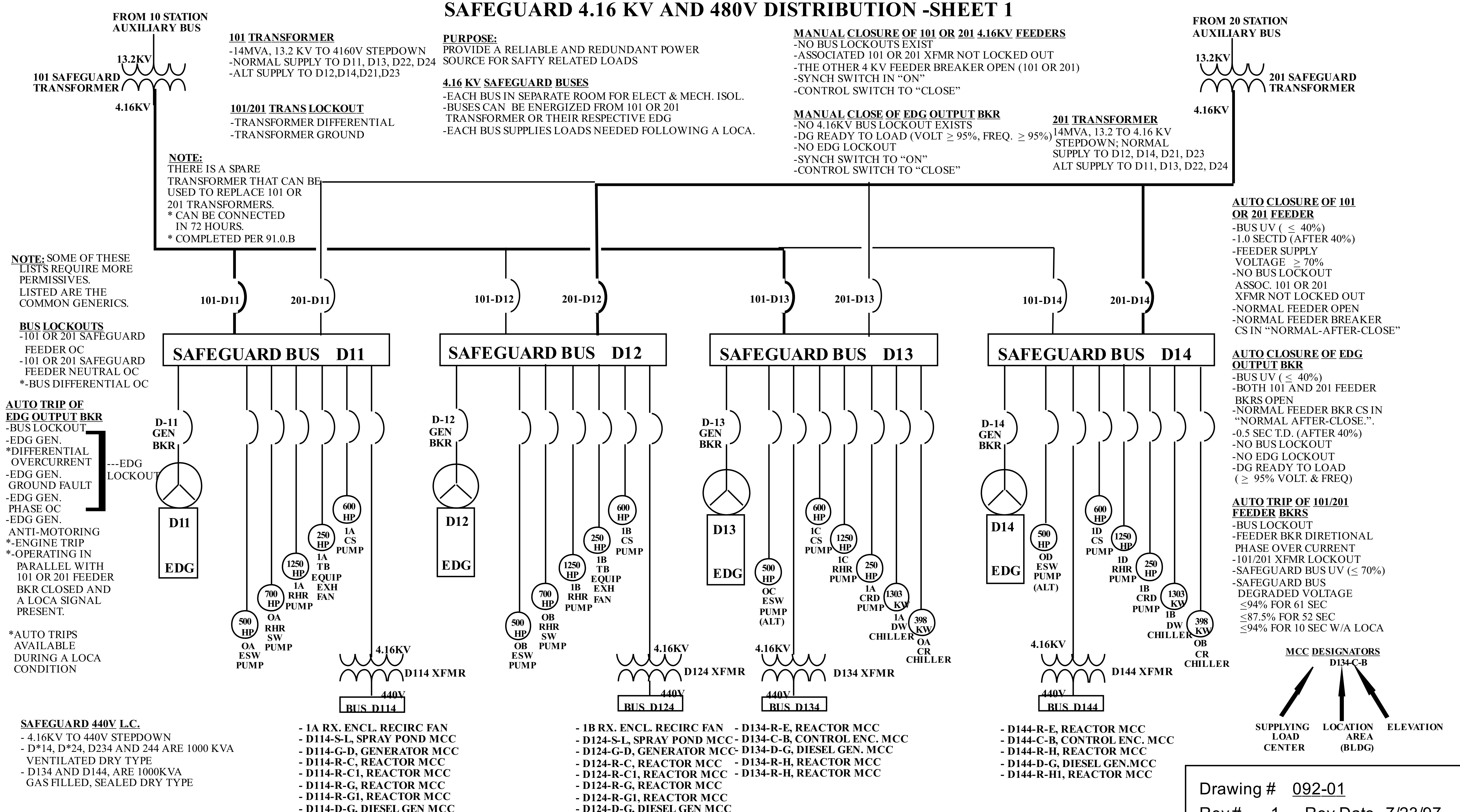
**ATTACHMENT 4**

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**Safeguard 4.16 KV and 480V Distribution Simplified Diagram**

# SAFEGUARD 4.16 KV AND 480V DISTRIBUTION -SHEET 1




Drawing # 092-01
Rev # 1 Rev Date 7/23/97

Instructor Signature
X

**ATTACHMENT 5**

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**Safety Related Pump Data**

| Item No. | Pump No. | Component ID(s) | Pump Description | Load | Rating (HP) | Rating (kV) | Nominal Speed (RPM) | Synchronous Speed (RPM) | Slip (%) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | P202 | 1A-P202 | 1A RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| | | 1B-P202 | 1B RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| | | 1C-P202 | 1C RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| | | 1D-P202 | 1D RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| | | 2A-P202 | 2A RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1185 | 1200 | 1.25 | Drawing E11-C002-C-019, ER-LG-321-1002 Att. 14 |
| | | 2B-P202 | 2B RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| | | 2C-P202 | 2C RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| | | 2D-P202 | 2D RHR Pump | Pump, Vertical Line Shaft (Centrifugal) | 1250 | 4 | 1180 | 1200 | 1.67 | Drawing E11-C002-C-015, ER-LG-321-1002 Att. 14 |
| 2 | P206 | 1A-P206 | 1A Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 1B-P206 | 1B Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 1C-P206 | 1C Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 1D-P202 | 1D Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 2A-P206 | 2A Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 2B-P206 | 2B Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 2C-P206 | 2C Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| | | 2D-P206 | 2D Core Spray Pump | Pump, Vertical Line Shaft (Centrifugal) | 600 | 4 | 1775 | 1800 | 1.39 | Drawing E21-C001-C-001, ER-LG-321-1002 Att. 14, UFSAR 6.3.2.2.3 |
| 3 | P506 | 0A-P506 | A RHR Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 700 | 4 | 1175 | 1200 | 2.08 | Drawing E-008-B-00055 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 0B-P506 | B RHR Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 700 | 4 | 1175 | 1200 | 2.08 | Drawing E-008-B-00055 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 0C-P506 | C RHR Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 700 | 4 | 1175 | 1200 | 2.08 | Drawing E-008-B-00055 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 0D-P506 | D RHR Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 700 | 4 | 1175 | 1200 | 2.08 | Drawing E-008-B-00055 Sh. 1, ER-LG-321-1002 Att. 14 |
| 4 | P548 | 0A-P548 | A Emergency Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 500 | 4 | 1180 | 1200 | 1.67 | Drawing E-008-B-00054 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 0B-P548 | B Emergency Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 500 | 4 | 1180 | 1200 | 1.67 | Drawing E-008-B-00054 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 0C-P548 | C Emergency Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 500 | 4 | 1180 | 1200 | 1.67 | Drawing E-008-B-00054 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 0D-P548 | D Emergency Service Water Pump | Pump, Vertical Line Shaft (Centrifugal) | 500 | 4 | 1180 | 1200 | 1.67 | Drawing E-008-B-00054 Sh. 1, ER-LG-321-1002 Att. 14 |
| 14 | P514 | 1A-P514 | 1A Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 1B-P514 | 1B Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 1C-P514 | 1C Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1760 | 1800 | 2.22 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 1D-P514 | 1D Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 2A-P514 | 2A Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 2B-P514 | 2B Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 2C-P514 | 2C Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1760 | 1800 | 2.22 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 2D-P514 | 2D Diesel Generator Fuel Oil Transfer Pump | Pump, Vertical Line Shaft (Centrifugal) | 1.5 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-079-00017 Sh. 1, ER-LG-321-1002 Att. 14 |
| 22 | P162 | 0A-P612 | A Control Room Chiller Water Pump | Pump, Centrifugal | 25 | 0.46 | 1775 | 1800 | 1.39 | Drawing M-058-00080 Sh. 1, UFSAR Table 9.2-24 |
| | | 0B-P162 | B Control Room Chiller Water Pump | Pump, Centrifugal | 25 | 0.46 | 1775 | 1800 | 1.39 | Drawing M-058-00080 Sh. 1, UFSAR Table 9.2-24 |
| 35 | P168 | 0A-P168 | A Control Room Chiller Oil Pump | Pump, Positive Displacement | 1.5 | 0.46 | 1700 | 1800 | 5.56 | Drawing M-057-A-00013 Sh. 1, Carrier Training 19FA Series doc. |
| | | 0B-P168 | B Control Room Chiller Oil Pump | Pump, Positive Displacement | 1.5 | 0.46 | 1700 | 1800 | 5.56 | Drawing M-057-A-00013 Sh. 1, Carrier Training 19FA Series doc. |
| 65 | P256 | 1A-P256 | 1A Safeguard Piping Fill Pump | Pump, Centrifugal | 5 | 0.46 | 3490 | 3600 | 3.06 | Drawing M-164-00002 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 1B-P256 | 1B Safeguard Piping Fill Pump | Pump, Centrifugal | 5 | 0.46 | 3490 | 3600 | 3.06 | Drawing M-164-00002 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 2A-P256 | 2A Safeguard Piping Fill Pump | Pump, Centrifugal | 5 | 0.46 | 3490 | 3600 | 3.06 | Drawing M-164-00002 Sh. 1, ER-LG-321-1002 Att. 14 |
| | | 2B-P256 | 2B Safeguard Piping Fill Pump | Pump, Centrifugal | 5 | 0.46 | 3490 | 3600 | 3.06 | Drawing M-164-00002 Sh. 1, ER-LG-321-1002 Att. 14 |
| 83 | P208 | 1A-P208 | 1A Standby Liquid Control System Pump | Pump, Positive Displacement | 40 | 0.46 | 1755 | 1800 | 2.50 | ER-LGS-321-1002 Att. 14, UFSAR 3.9.2.2A.2.10, Same model as 2A-P208 |
| | | 1B-P208 | 1B Standby Liquid Control System Pump | Pump, Positive Displacement | 40 | 0.46 | 1755 | 1800 | 2.50 | ER-LGS-321-1002 Att. 14, UFSAR 3.9.2.2A.2.10, Same model as 2A-P209 |
| | | 1C-P208 | 1C Standby Liquid Control System Pump | Pump, Positive Displacement | 40 | 0.46 | 1755 | 1800 | 2.50 | ER-LGS-321-1002 Att. 14, UFSAR 3.9.2.2A.2.10, Same model as 2A-P210 |
| | | 2A-P208 | 2A Standby Liquid Control System Pump | Pump, Positive Displacement | 40 | 0.46 | 1755 | 1800 | 2.50 | Walkdown performed 6/23/20, ER-AA-321-1002 Att. 14, UFSAR 3.9.2.2A.2.10 |
| | | 2B-P208 | 2B Standby Liquid Control System Pump | Pump, Positive Displacement | 40 | 0.46 | 1755 | 1800 | 2.50 | ER-LGS-321-1002 Att. 14, UFSAR 3.9.2.2A.2.10, Same model as 2A-P208 |
| | | 2C-P208 | 2C Standby Liquid Control System Pump | Pump, Positive Displacement | 40 | 0.46 | 1755 | 1800 | 2.50 | ER-LGS-321-1002 Att. 14, UFSAR 3.9.2.2A.2.10, Same model as 2A-P209 |

**ATTACHMENT 6**

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**Safety Related Fan/Blower/Compressor Data**

| Item No. | Pump No. | Component ID(s) | Pump Description | Load | Rating (HP) | Rating (kV) | Nominal Speed (RPM) | Synchronous Speed (RPM) | Slip (%) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | V212 | 1A1-V212 | 1A1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1A2-V212 | 1A2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1B1-V212 | 1B1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1B2-V212 | 1B2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1C1-V212 | 1C1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1C2-V212 | 1C2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1D1-V212 | 1D1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1D2-V212 | 1D2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1E1-V212 | 1E1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1E2-V212 | 1E2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1F1-V212 | 1F1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1F2-V212 | 1F2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1G1-V212 | 1G1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Model number same as 1F1-V212 |
| | | 1G2-V212 | 1G2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Model number same as 1F1-V212 |
| | | 1H1-V212 | 1H1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Model number same as 1F1-V212 |
| | | 1H2-V212 | 1H2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Model number same as 1F1-V212 |
| | | 2A1-V212 | 2A1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2A2-V212 | 2A2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2B1-V212 | 2B1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2B2-V212 | 2B2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2C1-V212 | 2C1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2C2-V212 | 2C2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2D1-V212 | 2D1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2D2-V212 | 2D2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2E1-V212 | 2E1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2E2-V212 | 2E2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2F1-V212 | 2F1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 2F2-V212 | 2F2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1G1-V212 | 2G1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1G2-V212 | 2G2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1H1-V212 | 2H1 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |
| | | 1H2-V212 | 2H2 Drywell Cooler Fan | Fan, Vaneaxial | 30 | 0.46 | 3500 | 3600 | 2.78 | Drawing M-123-00001 Sh. 1 and Catalog ID 11428537 in PassPort |

| Item No. | Pump No. | Component ID(s) | Pump Description | Load | Rating (HP) | Rating (kV) | Nominal Speed (RPM) | Synchronous Speed (RPM) | Slip (%) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | V512 | 1A-V512 | 1A D11 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1B-V512 | 1B D12 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1C-V512 | 1C D13 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1D-V512 | 1D D14 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1E-V512 | 1E D11 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1F-V512 | 1F D12 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1G-V512 | 1G D13 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 1H-V512 | 1H D14 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2A-V512 | 2A D21 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2B-V512 | 2B D22 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2C-V512 | 2C D23 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2D-V512 | 2D D24 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2E-V512 | 2E D21 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2F-V512 | 2F D22 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2G-V512 | 2G D23 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| | | 2H-V512 | 2H D24 Diesel Generator Room Vent Fan | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | Drawing M-069-C-00028 Sh.1, M-069-C-00037 |
| 8 | V210 | 1A-V210 | 1A RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1B-V210 | 1B RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1C-V210 | 1C RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1D-V210 | 1D RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1E-V210 | 1E RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1F-V210 | 1F RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1G-V210 | 1G RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1H-V210 | 1H RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2A-V210 | 2A RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2B-V210 | 2B RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2C-V210 | 2C RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2D-V210 | 2D RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2E-V210 | 2E RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2F-V210 | 2F RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2G-V210 | 2G RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2H-V210 | 2H RHR Room Cooling Unit | Fan, Vaneaxial | 20 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| 9 | V211 | 1A-V211 | 1A Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1B-V211 | 1B Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1C-V211 | 1C Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1D-V211 | 1D Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1E-V211 | 1E Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1F-V211 | 1F Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1G-V211 | 1G Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1H-V211 | 1H Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2A-V211 | 2A Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2B-V211 | 2B Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2C-V211 | 2C Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2D-V211 | 2D Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2E-V211 | 2E Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2F-V211 | 2F Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2G-V211 | 2G Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2H-V211 | 2H Core Spray Room Cooling Unit | Fan, Vaneaxial | 10 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |

| Item No. | Pump No. | Component ID(s) | Pump Description | Load | Rating (HP) | Rating (kV) | Nominal Speed (RPM) | Synchronous Speed (RPM) | Slip (%) | Reference |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | V209 | 1A-V209 | 1A HPCI Room Cooling Unit | Fan, Vaneaxial | 15 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1B-V209 | 1B HPCI Room Cooling Unit | Fan, Vaneaxial | 15 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2A-V209 | 2A HPCI Room Cooling Unit | Fan, Vaneaxial | 15 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2B-V209 | 2B HPCI Room Cooling Unit | Fan, Vaneaxial | 15 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| 11 | V208 | 1A-V208 | 1A RCIC Room Cooling Unit | Fan, Vaneaxial | 5 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 1B-V208 | 1B RCIC Room Cooling Unit | Fan, Vaneaxial | 5 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2A-V208 | 2A RCIC Room Cooling Unit | Fan, Vaneaxial | 5 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 2B-V208 | 2B RCIC Room Cooling Unit | Fan, Vaneaxial | 5 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| 16 | V140 | 0A-V140 | A Standby Gas Treatment System Room Unit Cooler | Fan, Vaneaxial | 1 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-6, Drawing M-123-00322 Sh. 1 |
| | | 0B-V140 | B Standby Gas Treatment System Room Unit Cooler | Fan, Vaneaxial | 1 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| 17 | V141 | 0A-V141 | A Standby Gas Treatment System Room Access Unit Cooler | Fan, Vaneaxial | 7.5 | 0.46 | 3500 | 3600 | 2.78 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| | | 0B-V141 | B Standby Gas Treatment System Room Access Unit Cooler | Fan, Vaneaxial | 7.5 | 0.46 | 3500 | 3600 | 2.78 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| 18 | V163 | 0A-V163 | A Standby Gas Treatement System Exhaust Fan | Fan, Centrifugal | 40 | 0.46 | 3530 | 3600 | 1.94 | Drawing M054-C-00020 Sh. 1, UFSAR Table 6.2-14 |
| | | 0B-V163 | B Standby Gas Treatement System Exhaust Fan | Fan, Centrifugal | 40 | 0.46 | 3530 | 3600 | 1.94 | Drawing M054-C-00020 Sh. 1, UFSAR Table 6.2-14 |
| 19 | V213 | 1A-V213 | 1A Reactor Building Recircuilation Fan | Fan, Vaneaxial | 200 | 0.46 | 1788 | 1800 | 0.67 | Drawing M-069-C-00028 Sh.1 |
| | | 1B-V213 | 1B Reactor Building Recircuilation Fan | Fan, Vaneaxial | 200 | 0.46 | 1788 | 1800 | 0.67 | Drawing M-069-C-00028 Sh.1 |
| | | 2A-V213 | 2A Reactor Building Recircuilation Fan | Fan, Vaneaxial | 200 | 0.46 | 1788 | 1800 | 0.67 | Drawing M-069-C-00028 Sh.1 |
| | | 2B-V213 | 2B Reactor Building Recircuilation Fan | Fan, Vaneaxial | 200 | 0.46 | 1788 | 1800 | 0.67 | Drawing M-069-C-00028 Sh.1 |
| 21 | K112 | 0A-K112 | A Control Room Chiller | Compressor | 309 kW | 4 | 3556 | 3600 | 1.22 | Drawing M-057-A-00013 Sh. 1 |
| | | 0B-K112 | B Control Room Chiller | Compressor | 309 kW | 4 | 3556 | 3600 | 1.22 | Drawing M-057-A-00013 Sh. 1 |
| 23 | V114 | 0A-V114 | A Aux Panel & Computer Room Fan Coil Unit | Fan, Vaneaxial | 30 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| | | 0B-V114 | B Aux Panel & Computer Room Fan Coil Unit | Fan, Vaneaxial | 30 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| 24 | V120 | 0A-V120 | A Aux Panel & Computer Room Return Air Unit | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-1, Drawing M-069-00028 Sh. 1 |
| | | 0B-V120 | A Aux Panel & Computer Room Return Air Unit | Fan, Vaneaxial | 20 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-1, Drawing M-069-00028 Sh. 1 |
| 25 | V116 | 0A-V116 | A Control Room Air Condition Unit | Fan, Vaneaxial | 40 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| | | 0B-V116 | B Control Room Air Condition Unit | Fan, Vaneaxial | 40 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1 |
| 26 | V121 | 0A-V121 | A Control Room Return Air Fan | Fan, Vaneaxial | 15 | 0.46 | 1765 | 1800 | 1.94 | UFSAR Table 9.4-1, M-069-C-00028 Sh. 1 |
| | | 0B-V121 | B Control Room Return Air Fan | Fan, Vaneaxial | 15 | 0.46 | 1765 | 1800 | 1.94 | UFSAR Table 9.4-1, M-069-C-00028 Sh. 1 |
| 27 | V118 | 0A-V118 | A Emergency Switchgear & Battery Room Air Conditioning Unit | Fan, Vaneaxial | 15 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1. BHP is 11 |
| | | 0B-V118 | B Emergency Switchgear & Battery Room Air Conditioning Unit | Fan, Vaneaxial | 15 | 0.46 | 1770 | 1800 | 1.67 | UFSAR Table 9.4-1, Drawing M-123-00322 Sh. 1. BHP is 11 |
| 31 | V543 | 0A-V543 | A Spray Pond Pump Structure Heating Coil Fan | Fan, Vaneaxial | 10 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-14, Drawing M-123-00332 Sh. 1, BHP is 8.7 |
| | | 0B-V543 | B Spray Pond Pump Structure Heating Coil Fan | Fan, Vaneaxial | 10 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-14, Drawing M-123-00332 Sh. 1, BHP is 8.7 |
| | | 0C-V543 | C Spray Pond Pump Structure Heating Coil Fan | Fan, Vaneaxial | 10 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-14, Drawing M-123-00332 Sh. 1, BHP is 8.7 |
| | | 0D-V543 | D Spray Pond Pump Structure Heating Coil Fan | Fan, Vaneaxial | 10 | 0.46 | 1170 | 1200 | 2.50 | UFSAR Table 9.4-14, Drawing M-123-00332 Sh. 1, BHP is 8.7 |
| 34 | V127 | 0A-V127 | A Control Room Fresh Air Supply Fan | Fan, Centrifugal | 10 | 0.46 | 3500 | 3600 | 2.78 | UFSAR Table 9.4-1, Drawing M-054-A-00036 Sh. 1 |
| | | 0B-V127 | B Control Room Fresh Air Supply Fan | Fan, Centrifugal | 10 | 0.46 | 3500 | 3600 | 2.78 | UFSAR Table 9.4-1, Drawing M-054-A-00036 Sh. 1 |
| 63 | V131 | 0A-V131 | A SGTS Room Vent Exhaust Fan | Fan, Centrifugal | 10 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-054-B-00054 Sh. 1, UFSAR Table 9.4-1 |
| | | 0B-V131 | B SGTS Room Vent Exhaust Fan | Fan, Centrifugal | 10 | 0.46 | 1740 | 1800 | 3.33 | Drawing M-054-B-00054 Sh. 1, UFSAR Table 9.4-1 |

**ATTACHMENT 7**

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**Safety Related MOVs Analyzed**

Valves analyzed for stem thrust criteria

| Valve ID | Unit | Valve Type |
|---|---|---|
| FV-DO-101A | 1 | GLOBE2 |
| FV-DO-101B | 1 | GLOBE2 |
| FV-DO-201A | 2 | GLOBE2 |
| FV-DO-201B | 2 | GLOBE2 |
| HV-001-108 | 1 | GATE |
| HV-001-111 | 1 | GATE |
| HV-001-150 | 1 | GATE |
| HV-001-208 | 2 | GATE |
| HV-001-211 | 2 | GATE |
| HV-001-250 | 2 | GATE |
| HV-013-106 | 1 | GATE |
| HV-013-107 | 1 | GATE |
| HV-013-108 | 1 | GATE |
| HV-013-111 | 1 | GATE |
| HV-013-206 | 2 | GATE |
| HV-013-207 | 2 | GATE |
| HV-013-208 | 2 | GATE |
| HV-013-211 | 2 | GATE |
| HV-041-130B | 1 | GLOBE2 |
| HV-041-133A | 1 | GLOBE2 |
| HV-041-133B | 1 | GLOBE2 |
| HV-041-140 | 1 | GLOBE2 |
| HV-041-141 | 1 | GLOBE2 |
| HV-041-142 | 1 | GATE |
| HV-041-143 | 1 | GATE |
| HV-041-1F016 | 1 | GATE |
| HV-041-1F019 | 1 | GATE |
| HV-041-1F021 | 1 | GLOBE |
| HV-041-230A | 2 | GLOBE2 |
| HV-041-230B | 2 | GLOBE2 |
| HV-041-233A | 2 | GLOBE2 |
| HV-041-233B | 2 | GLOBE2 |
| HV-041-240 | 2 | GLOBE2 |
| HV-041-241 | 2 | GLOBE2 |
| HV-041-242 | 2 | GATE |
| HV-041-243 | 2 | GATE |
| HV-041-2F016 | 2 | GATE |
| HV-041-2F019 | 2 | GATE |
| HV-041-2F021 | 2 | GLOBE |
| HV-042-147A | 1 | GLOBE2 |
| HV-042-147B | 1 | GLOBE2 |
| HV-042-147C | 1 | GLOBE2 |
| HV-042-147D | 1 | GLOBE2 |
| HV-042-247A | 2 | GLOBE2 |
| HV-042-247B | 2 | GLOBE2 |
| HV-042-247C | 2 | GLOBE2 |

| Valve ID | Unit | Valve Type |
|---|---|---|
| HV-042-247D | 2 | GLOBE2 |
| HV-044-1F001 | 1 | GATE |
| HV-044-1F004 | 1 | GATE |
| HV-044-2F001 | 2 | GATE |
| HV-044-2F004 | 2 | GATE |
| HV-046-125 | 1 | GLOBE2 |
| HV-046-126 | 1 | GLOBE2 |
| HV-046-127 | 1 | GLOBE2 |
| HV-046-128 | 1 | GLOBE2 |
| HV-046-225 | 2 | GLOBE2 |
| HV-046-226 | 2 | GLOBE2 |
| HV-046-227 | 2 | GLOBE2 |
| HV-046-228 | 2 | GLOBE2 |
| HV-048-1F006A | 1 | GLOBE2 |
| HV-048-1F006B | 1 | GLOBE2 |
| HV-048-2F006A | 2 | GLOBE2 |
| HV-048-2F006B | 2 | GLOBE2 |
| HV-049-1F007 | 1 | GLOBE |
| HV-049-1F008 | 1 | GLOBE |
| HV-049-1F076 | 1 | GLOBE2 |
| HV-049-1F080 | 1 | GATE |
| HV-049-1F084 | 1 | GATE |
| HV-049-2F007 | 2 | GLOBE |
| HV-049-2F008 | 2 | GLOBE |
| HV-049-2F076 | 2 | GLOBE2 |
| HV-049-2F080 | 2 | GATE |
| HV-049-2F084 | 2 | GATE |
| HV-051-105A | 1 | GATE |
| HV-051-105B | 1 | GATE |
| HV-051-125A | 1 | GATE |
| HV-051-125B | 1 | GATE |
| HV-051-1F004A | 1 | GATE |
| HV-051-1F004B | 1 | GATE |
| HV-051-1F004C | 1 | GATE |
| HV-051-1F004D | 1 | GATE |
| HV-051-1F006A | 1 | GATE |
| HV-051-1F006B | 1 | GATE |
| HV-051-1F007A | 1 | GATE |
| HV-051-1F007B | 1 | GATE |
| HV-051-1F007C | 1 | GATE |
| HV-051-1F007D | 1 | GATE |
| HV-051-1F008 | 1 | GATE |
| HV-051-1F009 | 1 | GATE |
| HV-051-1F010A | 1 | GLOBE |
| HV-051-1F010B | 1 | GLOBE |
| HV-051-1F014A | 1 | GATE |
| HV-051-1F014B | 1 | GATE |
| HV-051-1F015A | 1 | GLOBE |

| Valve ID | Unit | Valve Type |
|---|---|---|
| HV-051-1F015B | 1 | GLOBE |
| HV-051-1F016A | 1 | GATE |
| HV-051-1F016B | 1 | GATE |
| HV-051-1F017A | 1 | GATE |
| HV-051-1F017B | 1 | GATE |
| HV-051-1F017C | 1 | GATE |
| HV-051-1F017D | 1 | GATE |
| HV-051-1F021A | 1 | GATE |
| HV-051-1F021B | 1 | GATE |
| HV-051-1F024A | 1 | GLOBE |
| HV-051-1F024B | 1 | GLOBE |
| HV-051-1F027A | 1 | GLOBE |
| HV-051-1F027B | 1 | GLOBE |
| HV-051-1F040 | 1 | GATE |
| HV-051-1F068A | 1 | GLOBE |
| HV-051-1F068B | 1 | GLOBE |
| HV-051-205A | 2 | GATE |
| HV-051-205B | 2 | GATE |
| HV-051-225A | 2 | GATE |
| HV-051-225B | 2 | GATE |
| HV-051-2F004A | 2 | GATE |
| HV-051-2F004B | 2 | GATE |
| HV-051-2F004C | 2 | GATE |
| HV-051-2F004D | 2 | GATE |
| HV-051-2F006A | 2 | GATE |
| HV-051-2F006B | 2 | GATE |
| HV-051-2F007A | 2 | GATE |
| HV-051-2F007B | 2 | GATE |
| HV-051-2F007C | 2 | GATE |
| HV-051-2F007D | 2 | GATE |
| HV-051-2F008 | 2 | GATE |
| HV-051-2F009 | 2 | GATE |
| HV-051-2F010A | 2 | GLOBE |
| HV-051-2F010B | 2 | GLOBE |
| HV-051-2F014A | 2 | GATE |
| HV-051-2F014B | 2 | GATE |
| HV-051-2F015A | 2 | GLOBE |
| HV-051-2F015B | 2 | GLOBE |
| HV-051-2F016A | 2 | GATE |
| HV-051-2F016B | 2 | GATE |
| HV-051-2F017A | 2 | GATE |
| HV-051-2F017B | 2 | GATE |
| HV-051-2F017C | 2 | GATE |
| HV-051-2F017D | 2 | GATE |
| HV-051-2F021A | 2 | GATE |
| HV-051-2F021B | 2 | GATE |
| HV-051-2F024A | 2 | GLOBE |
| HV-051-2F024B | 2 | GLOBE |

| Valve ID | Unit | Valve Type |
|---|---|---|
| HV-051-2F027A | 2 | GLOBE |
| HV-051-2F027B | 2 | GLOBE |
| HV-051-2F040 | 2 | GATE |
| HV-051-2F068A | 2 | GLOBE |
| HV-051-2F068B | 2 | GLOBE |
| HV-052-127 | 1 | GATE |
| HV-052-128 | 1 | GATE |
| HV-052-139 | 1 | GLOBE2 |
| HV-052-1F001A | 1 | GATE |
| HV-052-1F001B | 1 | GATE |
| HV-052-1F001C | 1 | GATE |
| HV-052-1F001D | 1 | GATE |
| HV-052-1F004A | 1 | GATE |
| HV-052-1F004B | 1 | GATE |
| HV-052-1F005 | 1 | GATE |
| HV-052-1F015A | 1 | GLOBE |
| HV-052-1F015B | 1 | GLOBE |
| HV-052-1F031A | 1 | GLOBE |
| HV-052-1F031B | 1 | GLOBE |
| HV-052-1F037 | 1 | GATE |
| HV-052-227 | 2 | GATE |
| HV-052-228 | 2 | GATE |
| HV-052-239 | 2 | GLOBE2 |
| HV-052-2F001A | 2 | GATE |
| HV-052-2F001B | 2 | GATE |
| HV-052-2F001C | 2 | GATE |
| HV-052-2F001D | 2 | GATE |
| HV-052-2F004A | 2 | GATE |
| HV-052-2F004B | 2 | GATE |
| HV-052-2F005 | 2 | GATE |
| HV-052-2F015A | 2 | GLOBE |
| HV-052-2F015B | 2 | GLOBE |
| HV-052-2F031A | 2 | GLOBE |
| HV-052-2F031B | 2 | GLOBE |
| HV-052-2F037 | 2 | GATE |
| HV-055-120 | 1 | GLOBE2 |
| HV-055-121 | 1 | GLOBE |
| HV-055-126 | 1 | GLOBE |
| HV-055-1F002 | 1 | GLOBE |
| HV-055-1F003 | 1 | GLOBE |
| HV-055-1F093 | 1 | GATE |
| HV-055-1F095 | 1 | GATE |
| HV-055-1F100 | 1 | GLOBE2 |
| HV-055-220 | 2 | GLOBE2 |
| HV-055-221 | 2 | GLOBE2 |
| HV-055-2F002 | 2 | GLOBE |
| HV-055-2F003 | 2 | GLOBE |
| HV-055-2F093 | 2 | GATE |

| Valve ID | Unit | Valve Type |
|---|---|---|
| HV-055-2F095 | 2 | GATE |
| HV-055-2F100 | 2 | GLOBE2 |
| HV-057-105 | 1 | GLOBE2 |
| HV-057-111 | 1 | GLOBE2 |
| HV-057-116 | 1 | GLOBE2 |
| HV-057-205 | 2 | GLOBE2 |
| HV-057-211 | 2 | GLOBE2 |
| HV-057-216 | 2 | GLOBE2 |
| HV-059-101 | 1 | GLOBE2 |
| HV-059-151A | 1 | GLOBE2 |
| HV-059-151B | 1 | GLOBE2 |
| HV-059-201 | 2 | GLOBE2 |
| HV-059-251A | 2 | GLOBE2 |
| HV-059-251B | 2 | GLOBE2 |
| HV-061-112 | 1 | GLOBE2 |
| HV-061-132 | 1 | GLOBE2 |
| HV-061-212 | 2 | GLOBE2 |
| HV-061-232 | 2 | GLOBE2 |
| HV-087-120A | 1 | GATE |
| HV-087-120B | 1 | GATE |
| HV-087-121A | 1 | GATE |
| HV-087-121B | 1 | GATE |
| HV-087-122 | 1 | GATE |
| HV-087-123 | 1 | GATE |
| HV-087-128 | 1 | GATE |
| HV-087-129 | 1 | GATE |
| HV-087-220A | 2 | GATE |
| HV-087-220B | 2 | GATE |
| HV-087-221A | 2 | GATE |
| HV-087-221B | 2 | GATE |
| HV-087-222 | 2 | GATE |
| HV-087-223 | 2 | GATE |
| HV-087-228 | 2 | GATE |
| HV-087-229 | 2 | GATE |

Valves analyzed for stem torque criteria

| Valve ID | Unit | Valve Type | Notes |
|---|---|---|---|
| HV-012-031A | 0 | BUTTERFLY1 | |
| HV-012-031B | 0 | BUTTERFLY1 | |
| HV-012-031C | 0 | BUTTERFLY1 | |
| HV-012-031D | 0 | BUTTERFLY1 | |
| HV-012-032A | 0 | BUTTERFLY1 | |
| HV-012-032B | 0 | BUTTERFLY1 | |
| HV-012-032C | 0 | BUTTERFLY1 | |
| HV-012-032D | 0 | BUTTERFLY1 | |
| HV-041-130A | 1 | GLOBE2 | |
| HV-057-109 | 1 | BUTTERFLY1 | |
| HV-057-112 | 1 | BUTTERFLY1 | |
| HV-057-115 | 1 | BUTTERFLY1 | |
| HV-057-135 | 1 | BUTTERFLY1 | |
| HV-057-147 | 1 | BUTTERFLY1 | |
| HV-057-161 | 1 | BUTTERFLY1 | |
| HV-057-162 | 1 | BUTTERFLY1 | |
| HV-057-163 | 1 | BUTTERFLY1 | |
| HV-057-164 | 1 | BUTTERFLY1 | |
| HV-057-166 | 1 | BUTTERFLY1 | |
| HV-057-169 | 1 | BUTTERFLY1 | |
| HV-057-209 | 2 | BUTTERFLY1 | |
| HV-057-212 | 2 | BUTTERFLY1 | |
| HV-057-215 | 2 | BUTTERFLY1 | |
| HV-057-235 | 2 | BUTTERFLY1 | |
| HV-057-247 | 2 | BUTTERFLY1 | |
| HV-057-261 | 2 | BUTTERFLY1 | |
| HV-057-262 | 2 | BUTTERFLY1 | |
| HV-057-263 | 2 | BUTTERFLY1 | |
| HV-057-264 | 2 | BUTTERFLY1 | |
| HV-057-266 | 2 | BUTTERFLY1 | |
| HV-057-269 | 2 | BUTTERFLY1 | |
| HV-C-051-1F048A | 1 | BUTTERFLY1 | No backseat |
| HV-C-051-1F048B | 1 | BUTTERFLY1 | No backseat |
| HV-C-051-2F048A | 2 | BUTTERFLY1 | No backseat |
| HV-C-051-2F048B | 2 | BUTTERFLY1 | No backseat |

Key: Gate = Standard Gate Valve
Globe = Standard Globe Valve
Globe2 = Rising Rotating Stem Globe Valve
Butterfly1 = Standard Butterfly Valve

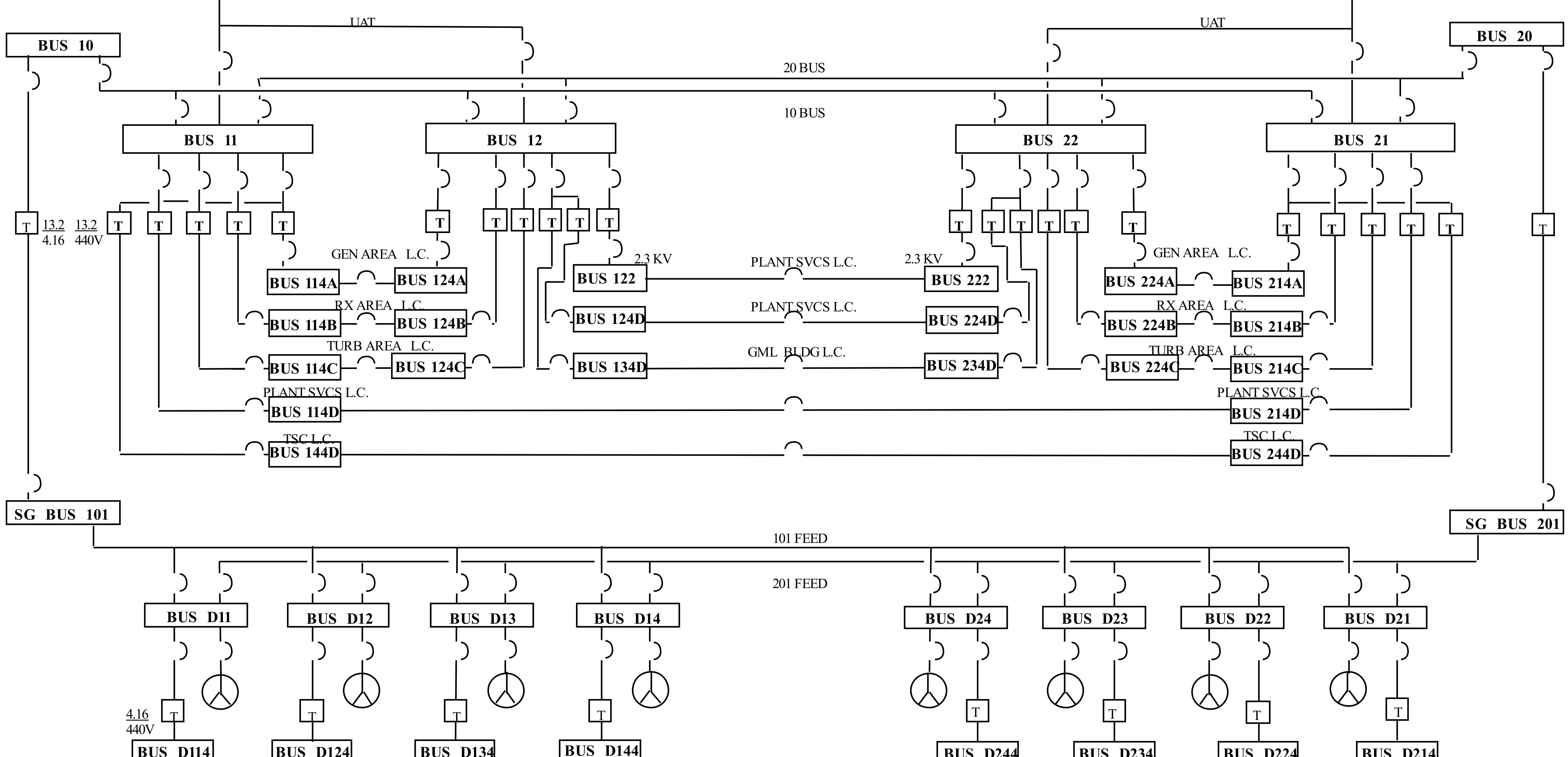
**ATTACHMENT 8**

**License Amendment Request**

**Limerick Generating Station, Units 1 and 2**
**Docket Nos. 50-352 and 50-353**

**LGS 480V Distribution System Simplified Diagram**

# LGS 480V DISTRIBUTION SYSTEM




**PURPOSE**
- DISTRIBUTE 480V ELECT POWER TO AUX. LOADS
- PROVIDE CONTROL & PROTECTION TO AUX EQUIPMENT

**EACH NON- SAFEGUARD L.C. BUS CONSISTS OF**
- 2 INDIV. L.C. SWGR PANELS
- EACH SWGR PANEL HAS IT'S OWN SUPPLY XFMR
- THE 2 PANELS CAN BE CONNECTED BY A TIE BKR (LOCATED IN A COMMON CABINET)

**MOTOR CONTROL CENTERS (MCC'S)**
-FED FROM LOAD CENTERS

**MCC DESIGNATORS**
MCC-114A-G-D

SUPPLYIING LOAD CENTER — LOCATION AREA — ELEVATION

**208/120V DISTRIBUTION**
- XFMR IN MCC'S

**OPERATING LINEUP**
- LC'S SPLIT
- LC'S POWERED FROM IT'S RESPECTIVE AUX BUS

**LC'S INTERLOCKS**
- IF BOTH SUPPLY BKRS SHUT-CAN'T SHUT CROSS-TIE
- IF ONE SUPPLY BKR & CROSS-TIE SHUT-CLOSING OTHER SUPPLY BKR TRIPS CROSS-TIE

**L.C. SUPPLY & CROSS TIE BKR CONTROL (NON-SAFEGUARD)**
- 3 POSITION "PREF-NORM-NON PREF" SEL SWITCH
- "NORMAL" IS 11 (U1) OR 12 (U2) AUX BUS
- ON LOW VOLTAGE, AUTO SWAP TO "NON-PREF" SOURCE
- MANUAL XFER BACK TO PREF SOURCE

Drawing # 093-01
Rev # 0 Rev Date 6/13/97

Instructor Signature
X _