



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

February 28, 2017

Mr. Bryan C. Hanson  
President and Chief Nuclear Officer  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – ISSUANCE OF  
AMENDMENTS TO REVISE HIGH PRESSURE COOLANT INJECTION  
SYSTEM AND REACTOR CORE ISOLATION COOLING SYSTEM ACTUATION  
INSTRUMENTATION TECHNICAL SPECIFICATIONS (CAC NOS. MF7555  
AND MF7556)

Dear Mr. Hanson:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment Nos. 224 and 185 to Renewed Facility Operating License Nos. NPF-39 and NPF-85 for the Limerick Generating Station, Units 1 and 2, respectively. These amendments consist of changes to the technical specifications (TSs) in response to your application dated April 4, 2016. The amendments revise the TS requirements for the high pressure coolant injection system and reactor core isolation cooling system actuation instrumentation.

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

Sincerely,

A handwritten signature in black ink, appearing to read "V. Sreenivas", is written over the typed name.

V. Sreenivas, Project Manager  
Plant Licensing Branch I  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-352 and 50-353

Enclosures:

1. Amendment No. 224 to NPF-39
2. Amendment No. 185 to NPF-85
3. Safety Evaluation

cc w/enclosures: Distribution via Listserv



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

EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-352

LIMERICK GENERATING STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 224  
Renewed License No. NPF-39

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (the licensee), dated April 4, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-39 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 224, are hereby incorporated into this renewed license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

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

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read 'Stephen S. Koenick', with a stylized flourish at the end.

Stephen S. Koenick, Acting Chief  
Plant Licensing Branch I  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

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

Date of Issuance: February 28, 2017

ATTACHMENT TO LICENSE AMENDMENT NO. 224

LIMERICK GENERATING STATION, UNIT 1

RENEWED FACILITY OPERATING LICENSE NO. NPF-39

DOCKET NO. 50-352

Replace the following page of the Renewed Facility Operating License with the revised page. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

Remove  
Page 3

Insert  
Page 3

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

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- (2) Pursuant to the Act and 10 CFR Part 70, to receive, possess and to use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Final Safety Analysis Report, as supplemented and amended;
- (3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;
- (4) Pursuant to the Act and 10 CFR Parts 30, 40, 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and
- (5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility, and to receive and possess, but not separate, such source, byproduct, and special nuclear materials as contained in the fuel assemblies and fuel channels from the Shoreham Nuclear Power Station.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I (except as exempted from compliance in Section 2.D. below) and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

Exelon Generation Company is authorized to operate the facility at reactor core power levels not in excess of 3515 megawatts thermal (100% rated power) in accordance with the conditions specified herein and in Attachment 1 to this license. The items identified in Attachment 1 to this renewed license shall be completed as specified. Attachment 1 is hereby incorporated into this renewed license.

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 224, are hereby incorporated into this renewed license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

TABLE 3.3.3-1

## EMERGENCY CORE COOLING SYSTEM ACTUATION INSTRUMENTATION

<u>TRIP FUNCTION</u>	<u>MINIMUM OPERABLE CHANNELS PER TRIP FUNCTION</u> <sup>(a)</sup>	<u>APPLICABLE OPERATIONAL CONDITIONS</u>	<u>ACTION</u>
1. <u>CORE SPRAY SYSTEM</u> ***			
a. Reactor Vessel Water Level - Low Low Low, Level 1	2/pump <sup>(b)</sup>	1, 2, 3, 4*, 5*	30
b. Drywell Pressure - High	2/pump <sup>(b)</sup>	1, 2, 3	30
c. Reactor Vessel Pressure - Low (Permissive)	6 <sup>(b)</sup>	1, 2, 3	31
		4*, 5*	32
d. Manual Initiation	2 <sup>(e)</sup>	1, 2, 3, 4*, 5	33
2. <u>LOW PRESSURE COOLANT INJECTION MODE OF RHR SYSTEM</u> ***			
a. Reactor Vessel Water Level - Low Low Low, Level 1	2	1, 2, 3, 4*, 5*	30
b. Drywell Pressure - High	2	1, 2, 3	30
c. Reactor Vessel Pressure - Low (Permissive)	2	1, 2, 3	31
d. Injection Valve Differential Pressure-Low (Permissive)	1/valve	1, 2, 3, 4*, 5*	31
e. Manual Initiation	1	1, 2, 3, 4*, 5*	33
3. <u>HIGH PRESSURE COOLANT INJECTION SYSTEM</u> ##			
a. Reactor Vessel Water Level - Low Low Level 2	4	1, 2, 3	34
b. Drywell Pressure - High <sup>###</sup>	4	1, 2, 3	34
c. Condensate Storage Tank Level - Low	2 <sup>(c)</sup>	1, 2, 3	35
d. Suppression Pool Water Level - High	2	1, 2, 3	35
e. Reactor Vessel Water Level - High, Level 8	4 <sup>(d)</sup>	1, 2, 3	31
f. Manual Initiation <sup>###</sup>	1/system	1, 2, 3	33

TABLE 3.3.3-1 (Continued)  
EMERGENCY CORE COOLING SYSTEM ACTUATION INSTRUMENTATION  
TABLE NOTATIONS

- (a) A channel may be placed in an inoperable status for up to 6 hours for required surveillance without placing the trip system in the tripped condition provided at least one OPERABLE channel in the same trip system is monitoring that parameter.
  - (b) Also provides input to actuation logic for the associated emergency diesel generators.
  - (c) One trip system. Provides signal to HPCI pump suction valves only.
  - (d) On 1 out of 2 taken twice logic, provides a signal to trip the HPCI pump turbine only.
  - (e) The manual initiation push buttons start the respective core spray pump and diesel generator. The "A" and "B" logic manual push buttons also actuate an initiation permissive in the injection valve opening logic.
  - (f) A channel as used here is defined as the 127 bus relay for Item 1 and the 127, 127Y, and 127Z feeder relays with their associated time delay relays taken together for Item 2.
- \* When the system is required to be OPERABLE per Specification 3.5.2.
- # Not required to be OPERABLE when reactor steam dome pressure is less than or equal to 100 psig.
- \*\* Required when ESF equipment is required to be OPERABLE.
- ## Not required to be OPERABLE when reactor steam dome pressure is less than or equal to 200 psig.
- ### The injection functions of Drywell Pressure - High and Manual Initiation are not required to be OPERABLE with reactor steam dome pressure less than 550 psig.

TABLE 3.3.5-1

REACTOR CORE ISOLATION COOLING SYSTEM ACTUATION INSTRUMENTATION

<u>FUNCTIONAL UNITS</u>	<u>MINIMUM OPERABLE CHANNELS PER TRIP FUNCTION*</u>	<u>ACTION</u>
a. Reactor Vessel Water Level - Low Low, Level 2	4#	50
b. Reactor Vessel Water Level - High, Level 8	4#	51
c. Condensate Storage Tank Water Level - Low	2**	52
d. Manual Initiation##	1/system***	53

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\*A channel may be placed in an inoperable status for up to 6 hours for required surveillance without placing the trip system in the tripped condition provided all other channels monitoring that parameter are OPERABLE.

\*\*One trip system with one-out-of-two logic.

\*\*\*One trip system with one channel.

#One trip system with one-out-of-two twice logic.

##The injection function of Manual Initiation is not required to be OPERABLE with reactor steam dome pressure less than 550 psig.





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

EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-353

LIMERICK GENERATING STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 185  
Renewed License No. NPF-85

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (the licensee), dated April 4, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

Enclosure 2

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-85 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 185, are hereby incorporated into this renewed license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

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

FOR THE NUCLEAR REGULATORY COMMISSION



Stephen S. Koenick, Acting Chief  
Plant Licensing Branch I  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

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

Date of Issuance: February 28, 2017

ATTACHMENT TO LICENSE AMENDMENT NO. 185

LIMERICK GENERATING STATION, UNIT 2

RENEWED FACILITY OPERATING LICENSE NO. NPF-85

DOCKET NO. 50-353

Replace the following page of the Renewed Facility Operating License with the revised page. The revised page is identified by amendment number and contains a marginal line indicating the area of change.

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Page 3

Insert  
Page 3

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

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- (2) Pursuant to the Act and 10 CFR Part 70, to receive, possess and to use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Final Safety Analysis Report, as supplemented and amended;
- (3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;
- (4) Pursuant to the Act and 10 CFR Parts 30, 40, 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and
- (5) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility, and to receive and possess, but not separate, such source, byproduct, and special nuclear materials as contained in the fuel assemblies and fuel channels from the Shoreham Nuclear Power Station.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I (except as exempted from compliance in Section 2.D. below) and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

Exelon Generation Company is authorized to operate the facility at reactor core power levels of 3515 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein.

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 185, are hereby incorporated into this renewed license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

TABLE 3.3.3-1

EMERGENCY CORE COOLING SYSTEM ACTUATION INSTRUMENTATION

<u>TRIP FUNCTION</u>	<u>MINIMUM OPERABLE CHANNELS PER TRIP FUNCTION</u> <sup>(a)</sup>	<u>APPLICABLE OPERATIONAL CONDITIONS</u>	<u>ACTION</u>
1. <u>CORE SPRAY SYSTEM</u> ***			
a. Reactor Vessel Water Level - Low Low Low, Level 1	2/pump <sup>(b)</sup>	1, 2, 3, 4*, 5*	30
b. Drywell Pressure - High	2/pump <sup>(b)</sup>	1, 2, 3,	30
c. Reactor Vessel Pressure - Low (Permissive)	6 <sup>(b)</sup>	1, 2, 3	31
		4*, 5*	32
d. Manual Initiation	2 <sup>(e)</sup>	1, 2, 3, 4*, 5*	33
2. <u>LOW PRESSURE COOLANT INJECTION MODE OF RHR SYSTEM</u> ***			
a. Reactor Vessel Water Level - Low Low Low, Level 1	2	1, 2, 3, 4*, 5*	30
b. Drywell Pressure - High	2	1, 2, 3	30
c. Reactor Vessel Pressure - Low (Permissive)	2	1, 2, 3	31
d. Injection Valve Differential Pressure-Low (Permissive)	1/valve	1, 2, 3, 4*, 5*	31
e. Manual Initiation	1	1, 2, 3, 4*, 5*	33
3. <u>HIGH PRESSURE COOLANT INJECTION SYSTEM</u> ##			
a. Reactor Vessel Water Level - Low Low, Level 2	4	1, 2, 3	34
b. Drywell Pressure - High###	4	1, 2, 3	34
c. Condensate Storage Tank Level - Low	2 <sup>(c)</sup>	1, 2, 3	35
d. Suppression Pool Water Level - High	2	1, 2, 3	35
e. Reactor Vessel Water Level - High, Level 8	4 <sup>(d)</sup>	1, 2, 3	31
f. Manual Initiation###	1/system	1, 2, 3	33

TABLE 3.3.3-1 (Continued)  
EMERGENCY CORE COOLING SYSTEM ACTUATION INSTRUMENTATION  
TABLE NOTATIONS

- (a) A channel may be placed in an inoperable status for up to 6 hours for required surveillance without placing the trip system in the tripped condition provided at least one OPERABLE channel in the same trip system is monitoring that parameter.
  - (b) Also provides input to actuation logic for the associated emergency diesel generators.
  - (c) One trip system. Provides signal to HPCI pump suction valves only.
  - (d) On 1 out of 2 taken twice logic, provides a signal to trip the HPCI pump turbine only.
  - (e) The manual initiation push buttons start the respective core spray pump and diesel generator. The "A" and "B" logic manual push buttons also actuate an initiation permissive in the injection valve opening logic.
  - (f) A channel as used here is defined as the 127 bus relay for Item 1 and the 127, 127Y, and 127Z feeder relays with their associated time delay relays taken together for Item 2.
- \* When the system is required to be OPERABLE per Specification 3.5.2.
- # Not required to be OPERABLE when reactor steam dome pressure is less than or equal to 100 psig.
- \*\* Required when ESF equipment is required to be OPERABLE.
- ## Not required to be OPERABLE when reactor steam dome pressure is less than or equal to 200 psig.
- ### The injection functions of Drywell Pressure - High and Manual Initiation are not required to be OPERABLE with reactor steam dome pressure less than 550 psig.

TABLE 3.3.5-1

REACTOR CORE ISOLATION COOLING SYSTEM ACTUATION INSTRUMENTATION

<u>FUNCTIONAL UNITS</u>	<u>MINIMUM OPERABLE CHANNELS PER TRIP FUNCTION*</u>	<u>ACTION</u>
a. Reactor Vessel Water Level - Low Low, Level 2	4#	50
b. Reactor Vessel Water Level - High, Level 8	4#	51
c. Condensate Storage Tank Water Level - Low	2**	52
d. Manual Initiation <sup>##</sup>	1/system***	53

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\*A channel may be placed in an inoperable status for up to 6 hours for required surveillance without placing the trip system in the tripped condition provided all other channels monitoring that parameter are OPERABLE.

\*\*One trip system with one-out-of-two logic.

\*\*\*One trip system with one channel.

#One trip system with one-out-of-two twice logic.

##The injection function of Manual Initiation is not required to be OPERABLE with reactor steam dome pressure less than 550 psig.



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 224 AND 185

TO RENEWED FACILITY OPERATING LICENSE NOS. NPF-39 AND NPF-85

EXELON GENERATION COMPANY, LLC

LIMERICK GENERATING STATION, UNITS 1 AND 2

DOCKET NOS. 50-352 AND 50-353

1.0 INTRODUCTION

By application dated April 4, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16095A275), Exelon Generation Company, LLC (the licensee) submitted a license amendment request (LAR) for the Limerick Generating Station (LGS), Units 1 and 2.

The proposed amendments would modify the high pressure coolant injection (HPCI) system and reactor core isolation cooling (RCIC) system actuation instrumentation technical specification (TS) requirements by adding a footnote indicating that the injection functions of drywell pressure-high (HPCI only) and manual initiation (HPCI and RCIC) are not required to be operable under low reactor pressure conditions. LGS, Units 1 and 2, are both General Electric (GE) Boiling-Water Reactor (BWR/4) Mark II designs.

2.0 REGULATORY EVALUATION

The U.S. Nuclear Regulatory Commission (NRC or the Commission) used the following requirements and guidance documents in evaluating the LAR:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36, "Technical specifications," in which the NRC established its regulatory requirements related to the contents of TSs. Specifically, the regulations in 10 CFR 50.36 (c)(2)(i) require that TSs include limiting conditions for operation (LCOs). LCOs are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When LCOs are not met, the licensee shall shut down the facility or follow the remedial action permitted by the TSs.
- Appendix A, "General Design Criteria for Nuclear Power Plants" (GDC) to 10 CFR Part 50, Criterion 13, "Instrumentation and control." Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can



affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.

- The NRC staff's guidance for review of TSs is in Chapter 16, "Technical Specifications," of NUREG-0800, Revision 3, "Standard Review Plan," March 2010 (ADAMS Accession No. ML100351425).

### 3.0 TECHNICAL EVALUATION

#### 3.1 Licensee's Proposed TS Changes

LGS TS 3/4.3.3, "Emergency Core Cooling System Actuation Instrumentation," specifies, in part, that the emergency core cooling system (ECCS) actuation instrumentation channels shown in Table 3.3.3-1 shall be operable with the Applicability as shown in Table 3.3.3-1. The licensee proposed the following changes:

1. Table 3.3.3-1 currently requires the HPCI System actuation on Drywell Pressure High and Manual Initiation to be operable in Modes 1, 2, and 3.

The proposed change is the insertion of a footnote to modify the applicability. The footnote states:

The injection functions of Drywell Pressure – High and Manual Initiation are not required to be OPERABLE with reactor steam dome pressure less than 550 psig [pounds per square inch gauge].

2. Table 3.3.5-1 currently requires the RCIC actuation on Manual Initiation to be operable in Modes 1, 2, and 3.

The proposed change is the insertion of a footnote to modify the applicability. The footnote states:

The injection function of Manual Initiation is not required to be OPERABLE with reactor steam dome pressure less than 550 psig.

#### 3.2 System Design

The LGS HPCI and RCIC systems (GE BWR/4 Technology Advanced Manual, Chapter 6, "BWR Differences" (ADAMS Accession No. ML023010606) and the LGS Updated Final Safety Analysis Report (UFSAR), Revision 18, Chapters 6 and 15) are single-train systems that provide a reliable source of high pressure coolant for cases where there is a loss of normal core coolant inventory.

##### 3.2.1 High Pressure Coolant Injection (HPCI) System Description

The purpose of the HPCI system is to ensure the reactor core is adequately cooled to limit fuel clad temperature in the event of a small break loss-of-coolant accident (LOCA) in the nuclear

system pressure boundary that does not result in a rapid depressurization of the reactor vessel. The HPCI system permits the reactor to be shut down, while maintaining sufficient reactor vessel water inventory until the reactor vessel pressure is reduced to the pressure, at which low pressure coolant injection (LPCI) and containment spray (CS) system operation can maintain core cooling.

The HPCI system consists of a steam turbine assembly driving a constant flow pump assembly and system piping, valves, controls, and instrumentation. The turbine steam supply piping, located downstream of two in-series primary containment isolation valves, supplies steam to the turbine via in-series motor-operated valve, hydraulically-operated stop valve, and hydraulically operated governor valve. Additional design details of the HPCI system are contained in UFSAR Section 6.3, "Emergency Core Cooling Systems."

If a LOCA occurs, the reactor scrams upon receipt of a low-low (L2) water level signal or a high drywell pressure signal. The HPCI system starts when the water level reaches a preselected height above the core or if high pressure exists in the primary containment. The HPCI system automatically stops when a high water level (+54 inches of water level or Level 8) in the reactor vessel is signaled.

### 3.2.2 Reactor Core Isolation Cooling (RCIC) System Description

The purpose of the RCIC system is to provide makeup water to the reactor vessel following reactor isolation in order to prevent the release of radioactive materials to the environment as a result of inadequate reactor core cooling. The RCIC system consists of a steam driven turbine pump and associated valves and piping capable of delivering makeup water to the reactor vessel. The system can be operated automatically or manually, and is credited in the LGS safety analysis for a design-basis control rod drop accident.

Similar to the HPCI system, RCIC consists of a steam driven turbine-pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel.

Following any reactor shutdown, steam generation continues due to heat produced by the radioactive decay of fission products. The steam normally flows to the main condenser through the turbine bypass or, if the condenser is isolated, through the relief valves to the suppression pool. The fluid removed from the reactor vessel can be entirely made up by the feedwater pumps or partially made up from the control rod drive system, which is supplied by the control rod drive feed pumps. If makeup water is required to supplement these primary sources of water, the RCIC turbine-pump unit either starts automatically upon receipt of a reactor vessel low-low (L2) water level signal or is started by the operator from the control room by remote manual controls.

RCIC is designed with a makeup capacity sufficient to prevent the reactor vessel water level from decreasing to the level where the core would be uncovered without the use of core standby cooling systems. The pump suction is normally lined up to the condensate storage tank. The backup supply of cooling water for the RCIC is the suppression pool. The RCIC system automatically stops when a high water level (+54 inches of water level or Level 8) in the reactor vessel is signaled.

### 3.3 NRC Staff Evaluation

As described, the HPCI and RCIC systems provide safety functions to mitigate postulated accidents. As such, operational requirements have been established for HPCI and RCIC in the TSs in accordance with the requirements of 10 CFR 50.36. This evaluation focus is to determine the acceptability of not requiring that the HPCI and RCIC systems be operable with reactor steam dome pressure up to 550 psig. In addition, because the HPCI and RCIC systems may be actuated by both level and pressure signals, the consequences of off-calibration of the actuation instrumentation is evaluated to demonstrate that the consequences of wide range reactor vessel water level off-calibration do not lead to a more severe reactor condition when low pressure conditions are considered. In addition, the NRC staff evaluated the impact of the proposed change on the HPCI and RCIC functions required in response to high drywell pressure condition.

#### 3.3.1 HPCI and RCIC Function at Low Pressure

The BWR/4 design consists of an emergency core cooling high pressure pumping system that delivers its flow to vessel annulus. The function of the HPCI and RCIC systems is to provide makeup coolant at high reactor pressure conditions to prevent core uncover when the reactor vessel water level is low. In its LAR, the licensee states that the functional pressure range for the HPCI and RCIC overlaps the operational range of the low-pressure systems, such as CS and LPCI, as well as the safety and relief valve overpressure setpoints. While these systems are primarily designed to operate at near-rated operating conditions, they are also capable to function near the low end of their operating pressure range to mitigate coolant losses from decay heat (RCIC) and small leaks or vessel line breaks (HPCI).

The NRC staff reviewed LGS UFSAR Chapters 1, 5, and 6, and confirmed that while the HPCI and RCIC systems are primarily designed to operate at near rated operating conditions (i.e., above 550 psig reactor steam dome pressure), they are also capable of functioning near the low end of their operating pressure range to mitigate coolant losses from decay heat (RCIC) and small leaks or vessel line breaks (HPCI). Although HPCI and RCIC are capable of operating in the low pressure range, their function is not relied upon due to the availability of the low pressure systems LPCI and CS.

#### 3.3.2 Consequences of Off-Calibration of the Wide Range Level Instrumentation at Low Pressure

Maintaining an acceptable water level in the reactor vessel ensures that coolant is available to dissipate core heat. To ensure complete and accurate coverage of reactor vessel level, separate instrumentations monitor different ranges of reactor vessel level. The instruments are at the vessel pressure and reference leg temperature in which the instrument will be used. As changes in temperature affect the density of water, any deviation from the calibrated condition could affect instrument accuracy.

As a result of these water density differences between the high pressure and low pressure actuations, the consequences of off-calibration of the wide range level instrumentation at low pressure are evaluated as follows:

- a. For the licensing basis, LOCA analysis is performed using SAFER and GESTR-LOCA methodology (ADAMS Accession No. ML102230242 (non-public)), as documented in the LGS UFSAR, Sections 1.2.4.2.13 and 6.3.3.7, and Table 6.3-5, the licensee states that the HPCI system, which is most effective for small breaks, is disabled by the limiting assumed single failure and, therefore, for this case, the off-calibration of the wide range level instrumentation and the delay of HPCI injection at low pressure are of no consequence.
- b. For the case where the HPCI system is credited in the LOCA analysis, the consequences of off-calibration of the wide range level instrumentation at low pressure are not significant, because the mass of water that provides the core cooling is unaffected by the density differences; thus, the core cooling analysis results would not be significantly affected. For larger break sizes where the vessel depressurizes faster, the mitigation capability of HPCI is minimal and, therefore, the impact of instrument off-calibration on level measurement is minimal and is acceptable.
- c. For the licensee analysis for loss of feedwater flow at rated conditions following a reactor scram, the NRC staff reviewed LGS UFSAR Chapters 1, 2, 3, 5, 6, and specifically 7, and confirmed that the mitigation by the RCIC and HPCI systems is demonstrated to be effective in preventing core uncover and actuation of the automatic depressurization system. Because there is no wide range off-calibration condition at rated pressure, the low pressure wide range level off-calibration behavior is not of concern for the short-term. However, for the long-term mitigation following the event, as the vessel is depressurized, the RCIC and HPCI systems maintain the level consistent with the wide range level indication. As such, for this case, the impact of instrument off-calibration on level measurement is minimal and is acceptable.
- d. For an assumed loss of normal makeup flow or water inventory loss, when the plant is in start-up or shut-down at low pressure conditions due to reactor vessel water level decrease (LGS UFSAR Chapters 6 and 15), the HPCI and RCIC systems would be initiated on low-low reactor vessel water level (L2) in a similar way as in the case of the licensing basis LOCA or loss of feedwater flow events described above. However, because the initial power conditions at low pressure would be in the 0 percent to 2 percent level, and more energy is required to boil the water at low pressure, the HPCI and RCIC systems provide more than enough water to mitigate the event and are more effective at providing core cooling than either the licensing basis LOCA or loss of feedwater flow events initiated at rated power and high pressure. As such, the impact of instrument off-calibration on level instrument is minimal and is acceptable.
- e. The LGS UFSAR, Revision 18, Chapter 1, references a BWR Owner Group (BWROG) evaluation results of accidents for the BWR/4 plants; the worst case transient is loss of feedwater event. The results of the studies indicate that the core remains covered during the entire course of the transient, either to RCIC operation or automatic or manual depressurization, permitting RCIC to provide low pressure inventory makeup to occur, even with failure of the HPCI system. Therefore, the impact of instrument off-calibration on level measurement is minimal and is acceptable.

Upon review of the LGS UFSAR, Revision 18, Chapters 6, and 15, to confirm the licensee's determination that the consequences of off-calibration of the wide range level instrumentation at low pressure are not significant and do not affect the core cooling analysis results, the NRC staff determined that the consequences of wide range reactor vessel water level off-calibration do not lead to a more severe reactor condition when low pressure conditions are considered. The effect of pressure on water density results in comparable mass inventory above the lower instrument tap; therefore, the wide range off-calibration condition has a minimal effect on the reactor water inventory available for core cooling. This capability is consistent with GDC 13 of Appendix A to 10 CFR Part 50. Upon evaluation of these conditions, the NRC staff finds that the LGS has appropriate controls to monitor reactor water content that can be used to cool the core as required.

### 3.3.3 HPCI Specific to the High Drywell Pressure Initiation Function

For a LOCA event initiating at low reactor pressures, HPCI automatically actuates and injects into the vessel when the wide range indicated level reaches the low-low level (L2) initiation setpoint, with or without the presence of the high drywell pressure actuation. The proposed change has no impact on HPCI actuation on high drywell pressure.

LGS ECCS-LOCA analysis of record reviewed (LGS UFSAR Revision 18, Chapters 6 and 15) by the NRC staff confirmed that a postulated LOCA at full power and normal operating pressure is bounding for a LOCA in the 200-550 psig range. Therefore, the staff concludes that the proposed change described in this LAR has no impact on the LGS licensing basis for ECCS response to a LOCA as indicated by high drywell pressure actuation.

## 4.0 NRC Staff Conclusion

The NRC staff reviewed the technical discussion of the proposed changes provided in its submittal dated April 4, 2016, to ensure the reasoning was logical, complete, and clearly written as described in Chapter 16 of NUREG-0800. The proposed changes would modify only the plant conditions for which the LCO would apply. No changes are proposed to the functional requirements specified in the LCO or to the remedial measures. The NRC staff also finds that no changes are proposed to the performance levels specified in the LCO or to the remedial measures; therefore, the regulations in 10 CFR 50.36(c)(2)(i) continue to be met. The NRC staff also finds that the proposed addition of a footnote to TSs indicating that, "The injection function of Manual Initiation is not required to be OPERABLE with reactor steam dome pressure less than 550 psig," is consistent with the plant design, licensing basis, and complies with GDC 13 of Appendix A to 10 CFR Part 50 and 10 CFR 50.36. Therefore, based on these findings, the NRC staff concludes that there is reasonable assurance that the requirements of 10 CFR 50.36 will continue to be met and, accordingly, the requested change is acceptable.

## 5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments. The State official had no comments.

## 6.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (81 FR 36620). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: F. Forsaty  
M. Chernoff

Date: February 28, 2017

SUBJECT: LIMERICK GENERATING STATION, UNITS 1 AND 2 – ISSUANCE OF AMENDMENTS TO REVISE HIGH PRESSURE COOLANT INJECTION SYSTEM AND REACTOR CORE ISOLATION COOLING SYSTEM ACTUATION INSTRUMENTATION TECHNICAL SPECIFICATIONS (CAC NOS. MF7555 AND MF7556) DATED FEBRUARY 28, 2017

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