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

January 28, 2019

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer (CNO)
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – ISSUANCE OF AMENDMENT NOS. 273 AND 268 REGARDING ADOPTION OF TSTF-542, "REACTOR PRESSURE VESSEL WATER INVENTORY CONTROL" (EPID L-2018-LLA-0049)

Dear Mr. Hanson:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 273 to Renewed Facility Operating License No. DPR-29 and Amendment No. 268 to Renewed Facility Operating License No. DPR-30 for Quad Cities Nuclear Power Station, Units 1 and 2. The amendments consist of changes to the technical specifications (TSs) in response to your application dated February 26, 2018, as supplemented by letter dated September 27, 2018.

The amendments add, delete, modify and replace numerous TS requirements related to operations with a potential for draining the reactor vessel with new requirements for reactor pressure vessel water inventory control to protect Safety Limit 2.1.1.3.

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

Sincerely,

Kimberly J. Green, Senior Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-254 and 50-265

Enclosures:
1. Amendment No. 273 to DPR-29
2. Amendment No. 268 to DPR-30
3. Safety Evaluation

cc: Listserv

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

EXELON GENERATION COMPANY, LLC

AND

MIDAMERICAN ENERGY COMPANY

DOCKET NO. 50-254

QUAD CITIES NUCLEAR POWER STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 273
Renewed License No. DPR-29

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

   A. The application for amendment by the Exelon Generation Company, LLC (the licensee) dated February 26, 2018, as supplemented by letter dated September 27, 2018, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 3.B of Renewed Facility Operating License No. DPR-29 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 273, are hereby incorporated into this renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented prior to initial entry into Mode 4 for Quad Cities Nuclear Power Station, Unit 1 refueling outage, Q1R25.

FOR THE NUCLEAR REGULATORY COMMISSION

David J. Wrona, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Date of Issuance: January 28, 2019

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

EXELON GENERATION COMPANY, LLC

AND

MIDAMERICAN ENERGY COMPANY

DOCKET NO. 50-265

QUAD CITIES NUCLEAR POWER STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 268
Renewed License No. DPR-30

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

   A. The application for amendment by the Exelon Generation Company, LLC (the licensee) dated February 26, 2018, as supplemented by letter dated September 27, 2018, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 3.B. of Renewed Facility Operating License No. DPR-30 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 268, are hereby incorporated into this renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented prior to initial entry into Mode 4 for Quad Cities Nuclear Power Station, Unit 1 refueling outage, Q1R25.

FOR THE NUCLEAR REGULATORY COMMISSION

David J. Wrona, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

Date of Issuance: January 28, 2019

ATTACHMENT TO LICENSE AMENDMENT NOS. 273 AND 268

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 and 2

RENEWED FACILITY OPERATING LICENSE NOS. DPR-29 AND DPR-30

DOCKET NOS. 50-254 AND 50-265

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

Remove	Insert
License DRP-29	License DPR-29
Page 4	Page 4
License DPR-30	License DPR-30
Page 4	Page 4
TSs	TSs

Remove	Insert	Remove	Insert	Remove	Insert
i	i	3.3.5.2-4	---	3.6.1.3-4	3.6.1.3-4
ii	ii	---	3.3.5.3-1	3.6.1.3-5	3.6.1.3-5
1.1-1	1.1-1	---	3.3.5.3-2	3.6.4.1-1	3.6.4.1-1
1.1-2	1.1-2	---	3.3.5.3-3	3.6.4.2-1	3.6.4.2-1
1.1-3	1.1-3	---	3.3.5.3-4	3.6.4.2-3	3.6.4.2-3
1.1-4	1.1-4	3.3.6.1-3	3.3.6.1-3	3.6.4.3-1	3.6.4.3-1
1.1-5	1.1-5	3.3.6.1-8	3.3.6.1-8	3.6.4.3-2	3.6.4.3-2
1.1-6	1.1-6	3.3.6.2-5	3.3.6.2-5	3.7.4-1	3.7.4-1
3.3.5.1-2	3.3.5.1-2	3.3.7.1-5	3.3.7.1-5	3.7.4-2	3.7.4-2
3.3.5.1-3	3.3.5.1-3	3.5.1-1	3.5.1-1	3.7.5-1	3.7.5-1
3.3.5.1-5	3.3.5.1-5	3.5.2-1	3.5.2-1	3.8.2-3	3.8.2-3
3.3.5.1-10	3.3.5.1-10	3.5.2-2	3.5.2-2	3.8.2-4	3.8.2-4
3.3.5.1-11	3.3.5.1-11	3.5.2-3	3.5.2-3	3.8.2-5	3.8.2-5
3.3.5.1-12	3.3.5.1-12	3.5.2-4	3.5.2-4	3.8.5-2	3.8.5-2
3.3.5.1-13	3.3.5.1-13	---	3.5.2-5	3.8.8-2	3.8.8-2
3.3.5.2-1	3.3.5.2-1	---	3.5.2-6		
3.3.5.2-2	3.3.5.2-2	3.5.3-1	3.5.3-1		
3.3.5.2-3	3.3.5.2-3				

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 273, are hereby incorporated into this renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. The licensee shall maintain the commitments made in response to the March 14, 1983, NUREG-0737 Order, subject to the following provision:

> The licensee may make changes to commitments made in response to the March 14, 1983, NUREG-0737 Order without prior approval of the Commission as long as the change would be permitted without NRC approval, pursuant to the requirements of 10 CFR 50.59. Consistent with this regulation, if the change results in an Unreviewed Safety Question, a license amendment shall be submitted to the NRC staff for review and approval prior to implementation of the change.

D. Equalizer Valve Restriction

Three of the four valves in the equalizer piping between the recirculation loops shall be closed at all times during reactor operation with one bypass valve open to allow for thermal expansion of water.

E. The licensee shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822), and the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined sets of plans[1], which contain Safeguards Information protected under 10 CFR 73.21, is entitled: "Quad Cities Nuclear Power Station Security Plan, Training and Qualification Plan, and Safeguards Contingency Plan, Revision 2," submitted by letter dated May 17, 2006.

Exelon Generation Company shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Exelon Generation Company CSP was approved by License Amendment No. 249 as modified by License Amendment No. 259.

F. The licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the Updated Final Safety Analysis Report for the facility and as approved in the Safety Evaluation Reports dated July 27, 1979 with supplements dated November 5, 1980, and

[1] The Training and Qualification Plan and Safeguards Contingency Plan are Appendices to the Security Plan.

B. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 268, are hereby incorporated into this renewed operating license. The licensee shall operate the facility in accordance with the Technical Specifications.

C. The licensee shall maintain the commitments made in response to the March 14, 1983, NUREG-0737 Order, subject to the following provision:

> The licensee may make changes to commitments made in response to the March 14, 1983, NUREG-0737 Order without prior approval of the Commission as long as the change would be permitted without NRC approval, pursuant to the requirements of 10 CFR 50.59. Consistent with this regulation, if the change results in an Unreviewed Safety Question, a license amendment shall be submitted to the NRC staff for review and approval prior to implementation of the change.

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Exelon Generation Company shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Exelon Generation Company CSP was approved by License Amendment No. 244 and modified by License Amendment No. 254.

F. The licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the Updated Final Safety Analysis Report for the facility and as approved in the Safety Evaluation Reports dated July 27, 1979 with supplements dated

[1] The Training and Qualification Plan and Safeguards Contingency Plan are Appendices to the Security Plan.

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(continued)

(continued)

1.0 USE AND APPLICATION

1.1 Definitions

----------NOTE----------
The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

Term	Definition
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)	The APLHGR shall be applicable to a specific planar height and is equal to the sum of the LHGRs for all the fuel rods in the specified bundle at the specified height divided by the number of fuel rods in the fuel bundle at the height.
CHANNEL CALIBRATION	A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The CHANNEL CALIBRATION shall encompass all devices in the channel required for channel OPERABILITY and the CHANNEL FUNCTIONAL TEST. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps.
CHANNEL CHECK	A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

(continued)

1.1 Definitions (continued)

CHANNEL FUNCTIONAL TEST	A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The CHANNEL FUNCTIONAL TEST may be performed by means of any series of sequential, overlapping, or total channel steps.
CORE ALTERATION	CORE ALTERATION shall be the movement of any fuel, sources, or reactivity control components, within the reactor vessel with the vessel head removed and fuel in the vessel. The following exceptions are not considered to be CORE ALTERATIONS: a. Movement of source range monitors, local power range monitors, intermediate range monitors, traversing incore probes, or special movable detectors (including undervessel replacement); and b. Control rod movement, provided there are no fuel assemblies in the associated core cell. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.
CORE OPERATING LIMITS REPORT (COLR)	The COLR is the unit specific document that provides cycle specific parameter limits for the current reload cycle. These cycle specific limits shall be determined for each reload cycle in accordance with Specification 5.6.5. Plant operation within these limits is addressed in individual Specifications.
DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The dose conversion factors used for this calculation shall be the inhalation committed dose conversion factors in Federal Guidance Report 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1989.

(continued)

1.1 Definitions (continued)

DRAIN TIME

The DRAIN TIME is the time it would take for the water inventory in and above the Reactor Pressure Vessel (RPV) to drain to the top of the active fuel (TAF) seated in the RPV assuming:

a. The water inventory above the TAF is divided by the limiting drain rate;

b. The limiting drain rate is the larger of the drain rate through a single penetration flow path with the highest flow rate, or the sum of the drain rates through multiple penetration flow paths susceptible to a common mode failure (e.g., seismic event, loss of normal power, single human error), for all penetration flow paths below the TAF except:

   1. Penetration flow paths connected to an intact closed system, or isolated by manual or automatic valves that are locked, sealed, or otherwise secured in the closed position, blank flanges, or other devices that prevent flow of reactor coolant through the penetration flow paths;

   2. Penetration flow paths capable of being isolated by valves that will close automatically without offsite power prior to the RPV water level being equal to the TAF when actuated by RPV water level isolation instrumentation; or

   3. Penetration flow paths with isolation devices that can be closed prior to the RPV water level being equal to the TAF by a dedicated operator trained in the task, who is in continuous communication with the control room, is stationed at the controls, and is capable of closing the penetration flow path isolation device without offsite power.

(continued)

1.1 Definitions

DRAIN TIME (continued)	c. The penetration flow paths required to be evaluated per paragraph b) are assumed to open instantaneously and are not subsequently isolated, and no water is assumed to be subsequently added to the RPV water inventory; d. No additional draining events occur; and e. Realistic cross-sectional areas and drain rates are used. A bounding DRAIN TIME may be used in lieu of a calculated value.
INSERVICE TESTING PROGRAM	The INSERVICE TESTING PROGRAM is the licensee program that fulfills the requirements of 10 CFR 50.55a(f).
LEAKAGE	LEAKAGE shall be: a. Identified LEAKAGE 1. LEAKAGE into the drywell, such as that from pump seals or valve packing, that is captured and conducted to a sump or collecting tank; or 2. LEAKAGE into the drywell atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary LEAKAGE; b. Unidentified LEAKAGE All LEAKAGE into the drywell that is not identified LEAKAGE; c. Total LEAKAGE Sum of the identified and unidentified LEAKAGE; and

(continued)

1.1 Definitions

LEAKAGE (continued)	d. Pressure Boundary LEAKAGE LEAKAGE through a nonisolable fault in a Reactor Coolant System (RCS) component body, pipe wall, or vessel wall.
LINEAR HEAT GENERATION RATE (LHGR)	The LHGR shall be the heat generation rate per unit length of fuel rod. It is the integral of the heat flux over the heat transfer area associated with the unit length.
LOGIC SYSTEM FUNCTIONAL TEST	A LOGIC SYSTEM FUNCTIONAL TEST shall be a test of all logic components required for OPERABILITY of a logic circuit, from as close to the sensor as practicable up to, but not including, the actuated device, to verify OPERABILITY. The LOGIC SYSTEM FUNCTIONAL TEST may be performed by means of any series of sequential, overlapping, or total system steps so that the entire logic system is tested.
MINIMUM CRITICAL POWER RATIO (MCPR)	The MCPR shall be the smallest critical power ratio (CPR) that exists in the core for each class of fuel. The CPR is that power in the assembly that is calculated by application of the appropriate correlation(s) to cause some point in the assembly to experience boiling transition, divided by the actual assembly operating power.
MODE	A MODE shall correspond to any one inclusive combination of mode switch position, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 1.1-1 with fuel in the reactor vessel.
OPERABLE—OPERABILITY	A system, subsystem, division, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, division, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).

(continued)

1.1 Definitions (continued)

RATED THERMAL POWER (RTP)	RTP shall be a total reactor core heat transfer rate to the reactor coolant of 2957 MWt.
REACTOR PROTECTION SYSTEM (RPS) RESPONSE TIME	The RPS RESPONSE TIME shall be that time interval from the opening of the sensor contact until the opening of the trip actuator. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured.
SHUTDOWN MARGIN (SDM)	SDM shall be the amount of reactivity by which the reactor is subcritical or would be subcritical throughout the operating cycle assuming that: a. The reactor is xenon free; b. The moderator temperature is $\geq$ 68°F, corresponding to the most reactive state; and c. All control rods are fully inserted except for the single control rod of highest reactivity worth, which is assumed to be fully withdrawn. With control rods not capable of being fully inserted, the reactivity worth of these control rods must be accounted for in the determination of SDM.
THERMAL POWER	THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.
TURBINE BYPASS SYSTEM RESPONSE TIME	The TURBINE BYPASS SYSTEM RESPONSE TIME shall be that time interval from when the turbine bypass control unit generates a turbine bypass valve flow signal until the turbine bypass valves travel to their required positions. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. As required by Required Action A.1 and referenced in Table 3.3.5.1-1.	B.1	--------NOTE-------- Only applicable for Functions 1.a, 1.b, 2.a, 2.b, 2.d, and 2.j. ----------	
		Declare supported feature(s) inoperable when its redundant feature ECCS initiation capability is inoperable.	1 hour from discovery of loss of initiation capability for feature(s) in both divisions
	AND		
	B.2	--------NOTE-------- Only applicable for Functions 3.a and 3.b. ----------	
		Declare High Pressure Coolant Injection (HPCI) System inoperable.	1 hour from discovery of loss of HPCI initiation capability
	AND		
	B.3	Place channel in trip.	24 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. As required by Required Action A.1 and referenced in Table 3.3.5.1-1.	C.1 --------NOTE--------- Only applicable for Functions 1.c, 1.e, 2.c, 2.e, 2.g, 2.h, 2.i, and 2.k. --- Declare supported feature(s) inoperable when its redundant feature ECCS initiation capability is inoperable.	1 hour from discovery of loss of initiation capability for feature(s) in both divisions
	AND	
	C.2 Restore channel to OPERABLE status.	24 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. As required by Required Action A.1 and referenced in Table 3.3.5.1-1.	E.1 --------NOTE-------- Only applicable for Functions 1.d and 2.f. ---------- Declare supported feature(s) inoperable when its redundant feature ECCS initiation capability is inoperable. AND	1 hour from discovery of loss of initiation capability for subsystems in both divisions
	E.2 Restore channel to OPERABLE status.	7 days

(continued)

Table 3.3.5.1-1 (page 1 of 4)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Core Spray System					
a. Reactor Vessel Water Level–Low Low	1, 2, 3	4[a]	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ -55.2 inches
b. Drywell Pressure–High	1, 2, 3	4[a]	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≤ 2.43 psig
c. Reactor Steam Dome Pressure–Low (Permissive)	1, 2, 3	2	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 306 psig and ≤ 342 psig
d. Core Spray Pump Discharge Flow–Low (Bypass)	1, 2, 3	1 per pump	E	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ 577 gpm and ≤ 830 gpm
e. Core Spray Pump Start-Time Delay Relay	1, 2, 3	1 per pump	C	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 11.4 seconds
2. Low Pressure Coolant Injection (LPCI) System					
a. Reactor Vessel Water Level–Low Low	1, 2, 3	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ -55.2 inches
b. Drywell Pressure–High	1, 2, 3	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≤ 2.43 psig
c. Reactor Steam Dome Pressure–Low (Permissive)	1, 2, 3	2	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 306 psig and ≤ 342 psig

(continued)

(a) Also required to initiate the associated diesel generator (DG).

Table 3.3.5.1-1 (page 2 of 4)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
d. Reactor Steam Dome Pressure–Low (Break Detection)	1, 2, 3	4	B	SR 3.3.5.1.2 SR 3.3.5.1.5 SR 3.3.5.1.7	≥ 868 psig and ≤ 891 psig
e. Low Pressure Coolant Injection Pump Start-Time Delay Relay Pumps B and D	1, 2, 3	1 per pump	C	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 6.7 seconds
f. Low Pressure Coolant Injection Pump Discharge Flow–Low (Bypass)	1, 2, 3	1 per loop	E	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ 2526 gpm
g. Recirculation Pump Differential Pressure-High (Break Detection)	1, 2, 3	4 per pump	C	SR 3.3.5.1.2 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ 2.3 psid
h. Recirculation Riser Differential Pressure–High (Break Detection)	1, 2, 3	4	C	SR 3.3.5.1.2 SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 2.15 psid
i. Recirculation Pump Differential Pressure Time Delay–Relay (Break Detection)	1, 2, 3	2	C	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 0.82 seconds
j. Reactor Steam Dome Pressure Time Delay–Relay (Break Detection)	1, 2, 3	2	B	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 2.26 seconds
k. Recirculation Riser Differential Pressure Time Delay–Relay (Break Detection)	1, 2, 3	2	C	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 0.82 seconds

(continued)

Table 3.3.5.1-1 (page 3 of 4)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
3. High Pressure Coolant Injection (HPCI) System					
a. Reactor Vessel Water Level -Low Low	1, 2(b), 3(b)	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ -55.2 inches
b. Drywell Pressure—High	1, 2(b), 3(b)	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≤ 2.43 psig
c. Reactor Vessel Water Level—High	1, 2(b), 3(b)	2	C	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 50.34 inches
d. Contaminated Condensate Storage Tank (CCST) Level—Low	1, 2(b), 3(b)	2	D	SR 3.3.5.1.2 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ 598 ft 1 inch
e. Suppression Pool Water Level—High	1, 2(b), 3(b)	2	D	SR 3.3.5.1.2 SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 15 ft 11.25 inches
f. High Pressure Coolant Injection Pump Discharge Flow—Low (Bypass)	1, 2(b), 3(b)	1	E	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 634 gpm
g. Manual Initiation	1, 2(b), 3(b)	1	C	SR 3.3.5.1.7	NA
4. Automatic Depressurization System (ADS) Trip System A					
a. Reactor Vessel Water Level—Low Low	1, 2(b), 3(b)	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ -55.2 inches
b. Drywell Pressure—High	1, 2(b), 3(b)	2	F	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≤ 2.43 psig
c. Automatic Depressurization System Initiation Timer	1, 2(b), 3(b)	1	G	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 119 seconds

(continued)

(b) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 4 of 4)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
4. ADS Trip System A (continued)					
d. Core Spray Pump Discharge Pressure-High	1, 2(b), 3(b)	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 101.9 psig and ≤ 148.1 psig
e. Low Pressure Coolant Injection Pump Discharge Pressure-High	1, 2(b), 3(b)	4	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 101.6 psig and ≤ 148.4 psig
f. Automatic Depressurization System Low Low Water Level Actuation Timer	1, 2(b), 3(b)	1	G	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 530 seconds
5. ADS Trip System B					
a. Reactor Vessel Water Level–Low Low	1, 2(b), 3(b)	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.7	≥ -55.2 inches
b. Drywell Pressure–High	1, 2(b), 3(b)	2	F	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≤ 2.43 psig
c. Automatic Depressurization System Initiation Timer	1, 2(b), 3(b)	1	G	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 119 seconds
d. Core Spray Pump Discharge Pressure–High	1, 2(b), 3(b)	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 101.9 psig and ≤ 148.1 psig
e. Low Pressure Coolant Injection Pump Discharge Pressure–High	1, 2(b), 3(b)	4	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.7	≥ 101.6 psig and ≤ 148.4 psig
f. Automatic Depressurization System Low Low Water Level Actuation Timer	1, 2(b), 3(b)	1	G	SR 3.3.5.1.6 SR 3.3.5.1.7	≤ 530 seconds

(b) With reactor steam dome pressure > 150 psig.

3.3 INSTRUMENTATION

3.3.5.2 Reactor Pressure Vessel (RPV) Water Inventory Control Instrumentation

LCO 3.3.5.2 The RPV Water Inventory Control instrumentation for each Function in Table 3.3.5.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5.2-1.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.5.2-1 for the channel.	Immediately
B. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	B.1 Declare associated penetration flow path(s) incapable of automatic isolation. AND B.2 Calculate DRAIN TIME.	Immediately Immediately
C. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	C.1 Place channel in trip.	1 hour
D. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	D.1 Restore channel to OPERABLE status.	24 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time of Condition C or D not met.	E.1 Declare associated low pressure ECCS injection/spray subsystem inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

---------- NOTE ----------
Refer to Table 3.3.5.2-1 to determine which SRs apply for each ECCS Function.

SURVEILLANCE	FREQUENCY
SR 3.3.5.2.1 Perform CHANNEL CHECK.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2.2 Perform CHANNEL FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program

Table 3.3.5.2-1 (Page 1 of 1)
RPV Water Inventory Control Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Core Spray System					
a. Reactor Steam Dome Pressure–Low (Permissive)	4, 5	2 (a)	C	SR 3.3.5.2.2	≤ 342 psig
b. Core Spray Pump Discharge Flow–Low (Bypass)	4, 5	1 per pump (a)	D	SR 3.3.5.2.2	≥ 577 gpm and ≤ 830 gpm
2. Low Pressure Coolant Injection (LPCI) System					
a. Reactor Steam Dome Pressure–Low (Permissive)	4, 5	2 (a)	C	SR 3.3.5.2.2	≤ 342 psig
b. Low Pressure Coolant Injection Pump Discharge Flow–Low (Bypass)	4, 5	1 per loop (a)	D	SR 3.3.5.2.2	≥ 2526 gpm
3. RHR Shutdown Cooling System (SDC) Isolation					
a. Reactor Vessel Water Level–Low	(b)	1 per trip system	B	SR 3.3.5.2.1 SR 3.3.5.2.2	≥ 3.8 inches
4. Reactor Water Cleanup (RWCU) System Isolation					
a. Reactor Vessel Water Level–Low	(b)	1 per trip system	B	SR 3.3.5.2.1 SR 3.3.5.2.2	≥ 3.8 inches

(a) Associated with an ECCS subsystem required to be OPERABLE by LCO 3.5.2, "RPV Water Inventory Control."

(b) When automatic isolation of the associated penetration flow path(s) is credited in calculating DRAIN TIME.

3.3 INSTRUMENTATION

3.3.5.3 Reactor Core Isolation Cooling (RCIC) System Instrumentation

LCO 3.3.5.3 The RCIC System instrumentation for each Function in Table 3.3.5.3-1 shall be OPERABLE.

APPLICABILITY: MODE 1,
MODES 2 and 3 with reactor steam dome pressure > 150 psig.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.5.3-1 for the channel.	Immediately
B. As required by Required Action A.1 and referenced in Table 3.3.5.3-1.	B.1 Declare RCIC System inoperable. AND B.2 Place channel in trip.	1 hour from discovery of loss of RCIC initiation capability 24 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. As required by Required Action A.1 and referenced in Table 3.3.5.3-1.	C.1	Restore channel to OPERABLE status.	24 hours
D. As required by Required Action A.1 and referenced in Table 3.3.5.3-1.	D.1	--------NOTE-------- Only applicable if RCIC pump suction is not aligned to the suppression pool. ----------	
		Declare RCIC System inoperable.	1 hour from discovery of loss of RCIC initiation capability
	AND		
	D.2.1	Place channel in trip.	24 hours
	OR		
	D.2.2	Align RCIC pump suction to the suppression pool.	24 hours
E. Required Action and associated Completion Time of Condition B, C, or D not met.	E.1	Declare RCIC System inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

----------NOTES ----------

1. Refer to Table 3.3.5.3-1 to determine which SRs apply for each RCIC Function.

2. When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed as follows: (a) for up to 6 hours for Functions 2 and 5; and (b) for up to 6 hours for Functions 1, 3, and 4 provided the associated Function maintains RCIC initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.5.3.1	Perform CHANNEL CHECK.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.3.2	CALIBRATE the trip unit.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.3.3	Perform CHANNEL FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.3.4	Perform CHANNEL CALIBRATION.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.3.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program

Table 3.3.5.3-1 (page 1 of 1)
Reactor Core Isolation Cooling System Instrumentation

FUNCTION	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Vessel Water Level—Low Low	4	B	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4 SR 3.3.5.3.5	≥ -55.2 inches
2. Reactor Vessel Water Level—High	2	C	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4 SR 3.3.5.3.5	≤ 50.34 inches
3. Contaminated Condensate Storage Tank (CCST) Level-Low	2	D	SR 3.3.5.3.3 SR 3.3.5.3.4 SR 3.3.5.3.5	≥ 598 ft 1 inch
4. Suppression Pool Water Level—High	2	D	SR 3.3.5.3.3 SR 3.3.5.3.4 SR 3.3.5.3.5	≤ 15 ft 11.25 inches
5. Manual Initiation	1	C	SR 3.3.5.3.5	NA

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
G. Required Action and associated Completion Time for Condition F not met. OR As required by Required Action C.1 and referenced in Table 3.3.6.1-1.	G.1 Be in MODE 3. AND G.2 Be in MODE 4.	12 hours 36 hours
H. As required by Required Action C.1 and referenced in Table 3.3.6.1-1.	H.1 Declare associated standby liquid control subsystem (SLC) inoperable. OR H.2 Isolate the Reactor Water Cleanup System.	1 hour 1 hour
I. As required by Required Action C.1 and referenced in Table 3.3.6.1-1.	I.1 Initiate action to restore channel to OPERABLE status.	Immediately

Table 3.3.6.1-1 (page 3 of 3)
Primary Containment Isolation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION C.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
5. Reactor Water Cleanup System Isolation					
a. SLC System Initiation	1,2,3	1	H	SR 3.3.6.1.7	NA
b. Reactor Vessel Water Level–Low	1,2,3	2	F	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.6 SR 3.3.6.1.7	≥ 3.8 inches
6. RHR Shutdown Cooling System Isolation					
a. Reactor Vessel Pressure–High	1,2,3	2	F	SR 3.3.6.1.2 SR 3.3.6.1.4 SR 3.3.6.1.7	≤ 130 psig
b. Reactor Vessel Water Level–Low	3	2	I	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.3 SR 3.3.6.1.6 SR 3.3.6.1.7	≥ 3.8 inches

Table 3.3.6.2-1 (page 1 of 1)
Secondary Containment Isolation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Vessel Water Level—Low	1,2,3	2	SR 3.3.6.2.1 SR 3.3.6.2.2 SR 3.3.6.2.3 SR 3.3.6.2.5 SR 3.3.6.2.6	≥ 3.8 inches
2. Drywell Pressure—High	1,2,3	2	SR 3.3.6.2.2 SR 3.3.6.2.4 SR 3.3.6.2.6	≤ 2.43 psig
3. Reactor Building Exhaust Radiation—High	1,2,3,(a)	2	SR 3.3.6.2.1 SR 3.3.6.2.2 SR 3.3.6.2.4 SR 3.3.6.2.6	≤ 9 mR/hr
4. Refueling Floor Radiation-High	1,2,3,(a)	2	SR 3.3.6.2.1 SR 3.3.6.2.2 SR 3.3.6.2.4 SR 3.3.6.2.6	≤ 100 mR/hr

(a) During movement of recently irradiated fuel assemblies in secondary containment.

Table 3.3.7.1-1 (page 1 of 1)
Control Room Emergency Ventilation (CREV) System Isolation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Vessel Water Level–Low	1,2,3	2	C	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3 SR 3.3.7.1.5 SR 3.3.7.1.6	≥ 3.8 inches
2. Drywell Pressure–High	1,2,3	2	C	SR 3.3.7.1.2 SR 3.3.7.1.4 SR 3.3.7.1.6	≤ 2.43 psig
3. Main Steam Line Flow-High	1,2,3	2 per MSL	B	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3 SR 3.3.7.1.5 SR 3.3.7.1.6	≤ 248.1 psid[(b)]
4. Refueling Floor Radiation–High	1,2,3,(a)	2	B	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.4 SR 3.3.7.1.6	≤ 100 mR/hr
5. Reactor Building Ventilation Exhaust Radiation–High	1,2,3,(a)	2	B	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.4 SR 3.3.7.1.6	≤ 9 mR/hr

(a) During movement of recently irradiated fuel assemblies in the secondary containment.

(b) Function 3 is OPERABLE with an actual Trip Setpoint value found outside its calibration tolerance band provided the Trip Setpoint value is conservative with respect to its associated Allowable Value and the channel is re-adjusted to within the established setting tolerance band of the Nominal Trip Setpoint.

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS), REACTOR PRESSURE VESSEL (RPV) WATER INVENTORY CONTROL, AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.5.1 ECCS–Operating

LCO 3.5.1 Each ECCS injection/spray subsystem and the Automatic Depressurization System (ADS) function of five relief valves shall be OPERABLE.

APPLICABILITY: MODE 1,
MODES 2 and 3, except high pressure coolant injection (HPCI) and ADS valves are not required to be OPERABLE with reactor steam dome pressure ≤ 150 psig.

ACTIONS

----------NOTE----------
LCO 3.0.4.b is not applicable to HPCI.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Low Pressure Coolant Injection (LPCI) pump inoperable.	A.1 Restore LPCI pump to OPERABLE status.	30 days
B. One LPCI subsystem inoperable for reasons other than Condition A. OR One Core Spray subsystem inoperable.	B.1 Restore low pressure ECCS injection/spray subsystem to OPERABLE status.	7 days
C. One LPCI pump in each subsystem inoperable.	C.1 Restore one LPCI pump to OPERABLE status.	7 days
D. Required Action and associated Completion Time of Condition A, B, or C not met.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- D.1 Be in MODE 3.	 12 hours

(continued)

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS), REACTOR PRESSURE VESSEL (RPV) WATER INVENTORY CONTROL, AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.5.2 RPV Water Inventory Control

LCO 3.5.2 DRAIN TIME of RPV water inventory to the top of active fuel (TAF) shall be ≥ 36 hours.

AND

One low pressure ECCS injection/spray subsystem shall be OPERABLE.

---NOTE---
A Low Pressure Coolant Injection (LPCI) subsystem may be considered OPERABLE during alignment and operation for decay heat removal if capable of being manually realigned and not otherwise inoperable.

APPLICABILITY: MODES 4 and 5.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required ECCS injection/spray subsystem inoperable.	A.1 Restore required ECCS injection/spray subsystem to OPERABLE status.	4 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action to establish a method of water injection capable of operating without offsite electrical power.	Immediately

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. DRAIN TIME < 36 hours and ≥ 8 hours.	C.1 Verify secondary containment boundary is capable of being established in less than the DRAIN TIME.	4 hours
	AND	
	C.2 Verify each secondary containment penetration flow path is capable of being isolated in less than the DRAIN TIME.	4 hours
	AND	
	C.3 Verify one standby gas treatment subsystem is capable of being placed in operation in less than the DRAIN TIME.	4 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. DRAIN TIME < 8 hours.	D.1	------- NOTE -------- Required ECCS injection/spray subsystem or additional method of water injection shall be capable of operating without offsite electrical power. ----------	
		Initiate action to establish an additional method of water injection with water sources capable of maintaining RPV water level > TAF for ≥ 36 hours.	Immediately
	AND		
	D.2	Initiate action to establish secondary containment boundary.	Immediately
	AND		
			(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. (continued)	D.3 Initiate action to isolate each secondary containment penetration flow path or verify it can be manually isolated from the control room. AND	Immediately
	D.4 Initiate action to verify one standby gas treatment subsystem is capable of being placed in operation.	Immediately
E. Required Action and associated Completion Time of Condition C or D not met. OR DRAIN TIME < 1 hour.	E.1 Initiate action to restore DRAIN TIME to ≥ 36 hours.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.5.2.1 Verify DRAIN TIME ≥ 36 hours.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.2	Verify, for the required ECCS injection/spray subsystem, the: a. Suppression pool water level is ≥ 8.5 ft; or b. Contaminated condensate storage tank(s) water volume is ≥ 140,000 available gallons.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.3	Verify, for the required ECCS injection/spray subsystem, locations susceptible to gas accumulation are sufficiently filled with water.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.4	----------NOTE---------- Not required to be met for system vent flow paths opened under administrative control. ---------- Verify, for the required ECCS injection/spray subsystem, each manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program

(continued)

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.2.5	Operate the required ECCS injection/spray subsystem through the recirculation line for ≥ 10 minutes.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.6	Verify each valve credited for automatically isolating a penetration flow path actuates to the isolation position on an actual or simulated isolation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.7	----------NOTE---------- Vessel injection/spray may be excluded. ---------- Verify the required ECCS injection/spray subsystem can be manually operated.	In accordance with the Surveillance Frequency Control Program

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS), REACTOR PRESSURE VESSEL (RPV) WATER INVENTORY CONTROL, AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.5.3 RCIC System

LCO 3.5.3 The RCIC System shall be OPERABLE.

APPLICABILITY: MODE 1,
MODES 2 and 3 with reactor steam dome pressure > 150 psig.

ACTIONS

----------NOTE----------
LCO 3.0.4.b is not applicable to RCIC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCIC System inoperable.	A.1 Verify by administrative means High Pressure Coolant Injection System is OPERABLE. AND	Immediately
	A.2 Restore RCIC System to OPERABLE status.	14 days
B. Required Action and associated Completion Time not met.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. --- B.1 Be in MODE 3.	12 hours

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. (continued)	C.2 --------NOTES-------- 1. Isolation devices in high radiation areas may be verified by use of administrative means. 2. Isolation devices that are locked, sealed, or otherwise secured may be verified by use of administrative means. ---------- Verify the affected penetration flow path is isolated.	Once per 31 days
D. MSIV leakage rate not within limit.	D.1 Restore leakage rate to within limit.	8 hours
E. Required Action and associated Completion Time of Condition A, B, C, or D not met in MODE 1, 2, or 3.	E.1 Be in MODE 3. AND E.2 Be in MODE 4.	12 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.3.1	----------NOTE---------- Not required to be met when the 18 inch primary containment vent and purge valves are open for inerting, de-inerting, pressure control, ALARA or air quality considerations for personnel entry, or Surveillances that require the valves to be open, provided the drywell vent and purge valves and their associated suppression chamber vent and purge valves are not open simultaneously. ---------- Verify each 18 inch primary containment vent and purge valve, except for the torus purge valve, is closed.	In accordance with the Surveillance Frequency Control Program

(continued)

3.6 CONTAINMENT SYSTEMS

3.6.4.1 Secondary Containment

LCO 3.6.4.1 The secondary containment shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
During movement of recently irradiated fuel assemblies in the secondary containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Secondary containment inoperable in MODE 1, 2, or 3.	A.1 Restore secondary containment to OPERABLE status.	4 hours
B. Required Action and associated Completion Time of Condition A not met.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- B.1 Be in MODE 3.	12 hours
C. Secondary containment inoperable during movement of recently irradiated fuel assemblies in the secondary containment.	C.1 --------NOTE--------- LCO 3.0.3 is not applicable. ---------- Suspend movement of recently irradiated fuel assemblies in the secondary containment.	Immediately

3.6 CONTAINMENT SYSTEMS

3.6.4.2 Secondary Containment Isolation Valves (SCIVs)

LCO 3.6.4.2 Each SCIV shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
During movement of recently irradiated fuel assemblies in the secondary containment.

ACTIONS

----------NOTES----------
1. Penetration flow paths may be unisolated intermittently under administrative controls.

2. Separate Condition entry is allowed for each penetration flow path.

3. Enter applicable Conditions and Required Actions for systems made inoperable by SCIVs.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more penetration flow paths with one SCIV inoperable.	A.1 Isolate the affected penetration flow path by use of at least one closed and de-activated automatic valve, closed manual valve, or blind flange. AND	8 hours (continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, or 3.	C.1 Be in MODE 3. AND C.2 Be in MODE 4.	12 hours 36 hours
D. Required Action and associated Completion Time of Condition A or B not met during movement of recently irradiated fuel assemblies in the secondary containment.	D.1 --------NOTE--------- LCO 3.0.3 is not applicable. ---------- Suspend movement of recently irradiated fuel assemblies in the secondary containment.	 Immediately

3.6 CONTAINMENT SYSTEMS

3.6.4.3 Standby Gas Treatment (SGT) System

LCO 3.6.4.3 Two SGT subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
During movement of recently irradiated fuel assemblies in the secondary containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One SGT subsystem inoperable.	A.1 Restore SGT subsystem to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, or 3.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- B.1 Be in MODE 3.	12 hours
C. Required Action and associated Completion Time of Condition A not met during movement of recently irradiated fuel assemblies in the secondary containment.	----------NOTE---------- LCO 3.0.3 is not applicable. ---------- C.1 Place OPERABLE SGT subsystem in operation. OR	Immediately

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. (continued)	C.2 Suspend movement of recently irradiated fuel assemblies in secondary containment.	Immediately
D. Two SGT subsystems inoperable in MODE 1, 2, or 3.	D.1 Restore one SGT subsystem to OPERABLE status.	1 hour
E. Required Action and associated Completion Time of Condition D not met.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- E.1 Be in MODE 3.	12 hours
F. Two SGT subsystems inoperable during movement of recently irradiated fuel assemblies in the secondary containment.	F.1 --------NOTE-------- LCO 3.0.3 is not applicable. ---------- Suspend movement of recently irradiated fuel assemblies in secondary containment.	Immediately

3.7 PLANT SYSTEMS

3.7.4 Control Room Emergency Ventilation (CREV) System

LCO 3.7.4 The CREV System shall be OPERABLE.

----------NOTE----------
The main control room envelope (CRE) boundary may be opened intermittently under administrative control.

APPLICABILITY: MODES 1, 2, and 3,
During movement of recently irradiated fuel assemblies in the secondary containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. CREV System inoperable in MODE 1, 2, or 3 for reasons other than Condition C.	A.1 Restore CREV System to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, or 3.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. --- B.1 Be in MODE 3.	12 hours
C. CREV system inoperable due to inoperable CRE boundary in MODE 1, 2, or 3.	C.1 Initiate action to implement mitigating actions. AND C.2 Verify mitigating actions ensure CRE occupant exposures to radiological, chemical, and smoke hazards will not exceed limits AND	Immediately 24 hours (continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. (continued)	C.3 Restore CRE boundary to OPERABLE status	90 days
D. Required Action and associated Completion Time of Condition C not met in MODE 1, 2, or 3.	D.1 Be in MODE 3. AND D.2 Be in MODE 4.	12 hours 36 hours
E. CREV System inoperable during movement of recently irradiated fuel assemblies in the secondary containment. OR CREV System inoperable due to an inoperable CRE boundary during movement of recently irradiated fuel assemblies in the secondary containment.	----------NOTE---------- LCO 3.0.3 is not applicable. ---------- E.1 Suspend movement of recently irradiated fuel assemblies in the secondary containment.	Immediately

3.7 PLANT SYSTEMS

3.7.5 Control Room Emergency Ventilation Air Conditioning (AC) System

LCO 3.7.5 The Control Room Emergency Ventilation AC System shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
During movement of recently irradiated fuel assemblies in the secondary containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control Room Emergency Ventilation AC System inoperable in MODE 1, 2, or 3.	A.1 Restore Control Room Emergency Ventilation AC System to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, or 3.	----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- B.1 Be in MODE 3.	12 hours
C. Control Room Emergency Ventilation AC System inoperable during movement of recently irradiated fuel assemblies in the secondary containment.	----------NOTE---------- LCO 3.0.3 is not applicable. ---------- C.1 Suspend movement of recently irradiated fuel assemblies in the secondary containment.	Immediately

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.2 Suspend movement of recently irradiated fuel assemblies in the secondary containment. AND	Immediately
	A.2.3 Initiate action to restore required offsite power circuit to OPERABLE status.	Immediately

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One required DG inoperable.	B.1 Suspend CORE ALTERATIONS.	Immediately
	AND	
	B.2 Suspend movement of recently irradiated fuel assemblies in secondary containment.	Immediately
	AND	
	B.3 Initiate action to restore required DG to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.2.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.1.3, SR 3.8.1.10 through SR 3.8.1.12,and SR 3.8.1.14 through SR 3.8.1.19. ----------	
	For AC sources required to be OPERABLE the SRs of Specification 3.8.1, except SR 3.8.1.9, SR 3.8.1.13, SR 3.8.1.19, SR 3.8.1.20, and SR 3.8.1.21, are applicable.	In accordance with applicable SRs

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.3 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed for the 250 VDC electrical power subsystem: SR 3.8.4.6, SR 3.8.4.7, and SR 3.8.4.8. ----------	
	For DC electrical power subsystems required to be OPERABLE the following SRs are applicable: SR 3.8.4.1, SR 3.8.4.2, SR 3.8.4.3, SR 3.8.4.4, SR 3.8.4.5, SR 3.8.4.6, SR 3.8.4.7, and SR 3.8.4.8.	In accordance with applicable SRs

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.2 Suspend movement of recently irradiated fuel assemblies in the secondary containment. AND	Immediately
	A.2.3 Initiate actions to restore required AC and DC electrical power distribution subsystems to OPERABLE status. AND	Immediately
	A.2.4 Declare associated required shutdown cooling subsystem(s) inoperable and not in operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.8.1	Verify correct breaker alignments and voltage to required AC and DC electrical power distribution subsystems.	In accordance with the Surveillance Frequency Control Program

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 273 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-29

AND AMENDMENT NO. 268 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-30

EXELON GENERATION COMPANY, LLC

AND

MIDAMERICAN ENERGY COMPANY

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-254 AND 50-265

1.0 INTRODUCTION

By application dated February 26, 2018, as supplemented by letter dated September 27, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML18057B125 and ML18271A205, respectively), Exelon Generation Company, LLC (EGC, the licensee), acting for itself and MidAmerican Energy Company, requested to adopt Technical Specifications Task Force (TSTF) Traveler TSTF-542, Revision 2, "Reactor Pressure Vessel Water Inventory Control," (ADAMS Accession No. ML16074A448) for Quad Cities Nuclear Power Station, Unit Nos. 1 and 2 (QCNPS). Traveler TSTF-542, Revision 2, was approved by the U.S. Nuclear Regulatory Commission (NRC, the Commission) on December 20, 2016 (ADAMS Accession No. ML16343B008).

The proposed changes would add, delete, modify and replace existing technical specification (TS) requirements associated with "operations with a potential for draining the reactor vessel," (OPDRVs) with revised TSs providing an alternative requirement for Reactor Pressure Vessel (RPV) Water Inventory Control (WIC). These alternative requirements would protect TS Safety Limit 2.1.1.3, which states, "Reactor vessel water level shall be greater than the top of active irradiated fuel."

Additionally, a new definition for "DRAIN TIME" would be added to the QCNPS TS 1.1, "Definitions." DRAIN TIME would establish requirements for the licensee to make RPV water level inventory determinations and to calculate RPV water inventory drain rates for Modes 4 and 5 outage-related activities. Adequate licensee management of secondary containment requirements or mitigation of certain emergency core cooling system (ECCS) safety injection/spray systems during Modes 4 and 5 requires a properly calculated DRAIN TIME.

The licensee has proposed several variations from the TS changes described in the applicable parts of TSTF-542, Revision 2, or the NRC-approved TSTF-542 safety evaluation (SE). These are explained below in Section 2.2.5 and evaluated in Section 3.5 of this SE.

The supplemental letter dated September 27, 2018, provided additional information that clarified the application, but did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on April 24, 2018 (83 FR 17861).

2.0 REGULATORY EVALUATION

2.1 System Description

The boiling-water reactor (BWR) RPVs have a number of penetrations located below the top of active fuel (TAF). These penetrations provide entry for control rods, recirculation flow, reactor water cleanup (RWCU), and shutdown cooling. Because these penetrations are below the TAF, this creates a potential to drain the reactor vessel water inventory and lose effective core cooling. The loss of water inventory and effective core cooling can potentially lead to fuel cladding failure and radioactive release.

During operation in Modes 1 (Power Operation – Reactor Mode Switch in Run), 2 (Startup – Reactor Mode Switch in Refuel[1] or Startup/Hot Standby), and 3 (Hot Shutdown[1] - Reactor Mode Switch in Shutdown and average reactor coolant temperature > 212 ° (degrees Fahrenheit (F)), the TSs for instrumentation and ECCS require operability of sufficient equipment to ensure large quantities of water will be injected into the vessel should level decrease below the preselected value. These requirements are designed to mitigate the effects of a loss-of-coolant accident (LOCA), but also provide protection for other accidents and transients that involve a water inventory loss.

During BWR operation in Mode 4 (Cold Shutdown[1] – Reactor Mode Switch in Shutdown and average reactor coolant temperature ≤ 212 °F), and Mode 5 (Refueling[2] - Reactor Mode Switch in Shutdown or Refuel), the pressures and temperatures that could cause a LOCA are not present. During certain phases of refueling (Mode 5) a large volume of water is available above the RPV (i.e., the RPV head is removed), the water level is ≥ 23 ft over the top of the RPV flange, and the spent fuel storage pool gates are removed.

The large volume of water available in and above the RPV (during much of the time when in Mode 5) provides time for operator detection and manual operator action to stop and mitigate an RPV draining event. However, typically at other times during a refueling outage, during Cold Shutdown (Mode 4) or Refueling (Mode 5), there may be a potential for significant drainage paths from certain outage activities, human error, and other events when it is more likely to have some normally available equipment, instrumentation, and systems inoperable due to maintenance and outage activities. There may not be as much time for operator action as compared to times when there are large volumes of water above the RPV.

In comparison to Modes 1, 2, and 3, with typical high temperatures and pressures (especially in Modes 1 and 2), Modes 4 and 5 generally do not have the high pressure and temperature considered necessary for a LOCA envisioned from a high energy pipe failure. Thus, while the

---

1 With all reactor vessel head closure bolts fully tensioned.
2 One or more reactor vessel head closure bolts less than fully tensioned.

potential sudden loss of large volumes of water from a LOCA are not expected, operators monitor for BWR RPV water level decrease from potentially significant or unexpected drainage paths. These potential drainage paths in Modes 4 and 5 generally would require less water replacement capability to maintain water above TAF.

To address the drain down potential during Modes 4 and 5, the current QCNPS TSs contain specifications that are applicable during an OPDRV, or require suspension of OPDRVs if certain equipment is inoperable. The term OPDRV is not specifically defined in the TSs and historically has been subject to inconsistent application by licensees. The changes discussed in this SE are intended to resolve any ambiguity by creating a new RPV WIC TS with attendant equipment operability requirements, required actions and surveillance requirements (SRs) and deleting references to OPDRVs throughout the TS.

2.2 Proposed TS Changes

Section 2.2.1 of this SE describes the proposed addition of a new definition, "DRAIN TIME" (evaluated in Section 3.1 of this SE).

Section 2.2.2 describes: (1) the proposed revisions to TS 3.3, "Instrumentation," including the proposed revisions to TS 3.3.5.1, "Emergency Core Cooling System (ECCS) Instrumentation"; (2) the proposed addition of new TS 3.3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control Instrumentation" (including Table 3.3.5.2); and (3) proposed revisions to TS 3.3.6.1, "Primary Containment Isolation Instrumentation." These sections are evaluated in Sections 3.2 and 3.4 of this SE.

Section 2.2.3 describes the proposed revision to the title of TS 3.5, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling (RCIC) System," and the proposed revision to TS 3.5.2 "ECCS – Shutdown," which are evaluated in Section 3.3 of this SE.

Section 2.2.4 describes the proposed deletion of existing TS references to OPDRVs, which is evaluated in Section 3.6 of this SE.

Section 2.2.5 describes QCNPS plant-specific variations to TSTF-542, Revision 2, which are evaluated in Section 3.5 of this SE.

2.2.1 Addition of DRAIN TIME Definition

The following definition of "DRAIN TIME" would be added to Section 1.1, "Definitions":

> The DRAIN TIME is the time it would take for the water inventory in and above the Reactor Pressure Vessel (RPV) to drain to the top of the active fuel (TAF) seated in the RPV assuming:
>
> a. The water inventory above the TAF is divided by the limiting drain rate;
>
> b. The limiting drain rate is the larger of the drain rate through a single penetration flow path with the highest flow rate, or the sum of the drain rates through multiple penetration flow paths susceptible to a common mode failure (e.g., seismic event, loss of normal power, single human error), for all penetration flow paths below the TAF except:

1. Penetration flow paths connected to an intact closed system, or isolated by manual or automatic valves that are locked, sealed, or otherwise secured in the closed position, blank flanges, or other devices that prevent flow of reactor coolant through the penetration flow paths;

2. Penetration flow paths capable of being isolated by valves that will close automatically without offsite power prior to the RPV water level being equal to the TAF when actuated by RPV water level isolation instrumentation; or

3. Penetration flow paths with isolation devices that can be closed prior to the RPV water level being equal to the TAF by a dedicated operator trained in the task, who is in continuous communication with the control room, is stationed at the controls, and is capable of closing the penetration flow path isolation device without offsite power.

c. The penetration flow paths required to be evaluated per paragraph b) are assumed to open instantaneously and are not subsequently isolated, and no water is assumed to be subsequently added to the RPV water inventory;

d. No additional draining events occur; and

e. Realistic cross-sectional areas and drain rates are used.

A bounding DRAIN TIME may be used in lieu of a calculated value.

2.2.2 TS 3.3, "Instrumentation"

The following subsections describe the proposed changes to the QCNPS TS, Section 3.3, "Instrumentation."

2.2.2.1 TS Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation"

Proposed changes to TS 3.3.5.1 include the deletion of Note 1 in Required Actions B.1, C.1, and E.1, which states: "Only applicable in MODES 1, 2, and 3."

As a result, the numbering for Note 2 would be removed with no change in the note.

For TS Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation," the proposed changes delete the applicability in Modes 4 and 5 because the instrumentation requirements during shutdown would be consolidated into the new TS 3.3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control Instrumentation." Modes 4 and 5 Applicability and associated requirements would be deleted for the following functions:

1. Core Spray System:

(a) Reactor Vessel Water Level - Low
(c) Reactor Steam Dome Pressure - Low (Permissive)
(d) Core Spray Pump Discharge Flow - Low (Bypass)
(e) Core Spray Pump Start - Time Delay Relay

2. Low Pressure Coolant Injection (LPCI) System:

(a) Reactor Vessel Water Level - Low Low
(c) Reactor Steam Dome Pressure - Low (Permissive)
(e) Low Pressure Coolant Injection Pump Start - Time Delay Relay Pumps B and D
(f) Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)

In addition, Table 3.3.5.1-1 Footnote (a), which states, "When the associated ECCS subsystem(s) are required to be OPERABLE per [limiting condition for operation] LCO 3.5.2, 'ECCS-Shutdown,'" would be deleted. As a result, existing Footnotes (b) and (c) would be designated as (a) and (b), respectively.

2.2.2.2 New TS 3.3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control Instrumentation"

The proposed new TS 3.3.5.2 would contain existing "ECCS" and "Primary Containment Isolation" instrumentation functions that are relocated from TSs 3.3.5.1 and 3.3.6.1, as well as the creation of the LCO, APPLICABILITY, ACTIONS, SRs, and the addition of Footnote b to Table 3.3.5.2-1 because of the addition of Function 4a, which is being added to Table 3.3.5.2-1 due to the QCNPS-specific design as requested in Section 2.2.6 of the LAR, Item f. The proposed new TS 3.3.5.2 is shown below:

3.3.5.2 Reactor Pressure Vessel (RPV) Water Inventory Control Instrumentation

LCO 3.3.5.2 The RPV Water Inventory Control instrumentation for each Function in Table 3.3.5.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5.2-1.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.5.2-1 for the channel.	Immediately
B. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	B.1 Declare associated penetration flow path(s) incapable of automatic isolation. AND B.2 Calculate DRAIN TIME.	Immediately Immediately
C. As required by Required Action A.1	C.1 Place channel in trip.	1 hour

CONDITION	REQUIRED ACTION	COMPLETION TIME
and referenced in Table 3.3.5.2-1.		
D. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	D.1 Restore channel to OPERABLE status.	24 hours
E. Required Action and associated Completion Time of Condition C or D not met.	E.1 Declare associated low pressure ECCS injection/spray subsystem inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

----------NOTE----------
Refer to Table 3.3.5.2-1 to determine which SRs apply for each ECCS Function.

SURVEILLANCE	FREQUENCY
SR 3.3.5.2.1 Perform CHANNEL CHECK.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2.2 Perform CHANNEL FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program

Table 3.3.5.2-1 (Page 1 of 1)
RPV Water Inventory Control Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Core Spray System					
a. Reactor Steam Dome Pressure - Low (Permissive)	4, 5	2 (a)	C	SR 3.3.5.2.2	≤ 342 psig
b. Core Spray Pump Discharge Flow - Low (Bypass)	4, 5	1 per pump (a)	D	SR 3.3.5.2.2	≥ 577 gpm and ≤ 830 gpm

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. Low Pressure Coolant Injection (LPCI) System					
a. Reactor Steam Dome Pressure - Low (Permissive)	4, 5	2 (a)	C	SR 3.3.5.2.2	≤ 342 psig
b. Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)	4, 5	1 per loop (a)	D	SR 3.3.5.2.2	≥ 2526 gpm
3. RHR Shutdown Cooling System (SDC) Isolation					
a. Reactor Vessel Water Level - Low	(b)	1 per trip system	B	SR 3.3.5.2.1 SR 3.3.5.2.2	≥ 3.8 inches
4. Reactor Water Cleanup (RWCU) System Isolation					
a. Reactor Vessel Water Level - Low	(b)	1 per trip system	B	SR 3.3.5.2.1 SR 3.3.5.2.2	≥ 3.8 inches

(a) Associated with an ECCS subsystem required to be OPERABLE by LCO 3.5.2, "RPV Water Inventory Control."

(b) When automatic isolation of the associated penetration flow path(s) is credited in calculating DRAIN TIME.

2.2.2.3 Existing TS 3.3.5.2 Renumbered

Due to the creation of new TS 3.3.5.2, the existing TS 3.3.5.2 and all references to 3.3.5.2 contained therein would be renumbered as 3.3.5.3.

2.2.2.4 TS 3.3.6.1, "Primary Containment Isolation Instrumentation"

In TS Table 3.3.6.1-1, Function 6.b, "RHR [residual heat removal] Shutdown Cooling System Isolation, Reactor Vessel Water Level - Low," the applicability in Modes 4 and 5 would be deleted. Also, Footnote (b) to Table 3.3.6.1-1 would be deleted, as it is applicable only to Function 6.b during Modes 4 and 5. This function would be moved to the new TS Table 3.3.5.2-1, Function 3.a, as shown in Section 2.2.2.2 of this SE.

In TS LCO 3.3.6.1, Required Action I.2 would be deleted because it is associated with the isolation of RHR Shutdown Cooling during Modes 4 and 5, which as noted above would be deleted from TS Table 3.3.6.1-1.

2.2.3 TS Section 3.5, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling (RCIC) System"

The title of QCNPS TS Section 3.5 would be revised from "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling (RCIC) System" to "Emergency Core Cooling Systems (ECCS), Reactor Pressure Vessel (RPV) Water Inventory Control, and Reactor Core Isolation Cooling (RCIC) System."

The title of QCNPS TS Section 3.5.2 would be revised from "ECCS - Shutdown" to "RPV Water Inventory Control." The licensee proposed several changes to TS 3.5.2, including revisions to the LCO and the addition of a note, revision to the APPLICABILITY, changes to ACTIONS A, B, and D, addition of ACTIONS C and E, revisions to several SRs, deletion of SR 3.5.2.4, and addition of SRs 3.5.2.1, 3.5.2.5, and 3.5.2.6. The proposed TS 3.5.2 is shown below:

LCO 3.5.2 DRAIN TIME of RPV water inventory to the top of active fuel (TAF) shall be ≥ 36 hours.

AND

One low pressure ECCS injection/spray subsystem shall be OPERABLE.

---NOTE---
A Low Pressure Coolant Injection (LPCI) subsystem may be considered OPERABLE during alignment and operation for decay heat removal if capable of being manually realigned and not otherwise inoperable.

APPLICABILITY: MODES 4 and 5

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required ECCS injection/spray subsystem inoperable.	A.1 Restore required ECCS injection/spray subsystem to OPERABLE status.	4 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Initiate action to establish a method of water injection capable of operating without offsite electrical power.	Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. DRAIN TIME < 36 hours and ≥ 8 hour.	C.1 Verify secondary containment boundary is capable of being established in less than the DRAIN TIME. AND	4 hours
	C.2 Verify each secondary containment penetration flow path is capable of being isolated in less than the DRAIN TIME. AND	4 hours
	C.3 Verify one standby gas treatment subsystem is capable of being placed in operation in less than the DRAIN TIME.	4 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. DRAIN TIME < 8 hours.	D.1----------NOTE---------- Required ECCS injection/spray subsystem or additional method of water injection shall be capable of operating without offsite electrical power. ----------	
	Initiate action to establish an additional method of water injection with water sources capable of maintaining RPV water level > TAF for ≥ 36 hours.	Immediately
	AND	
	D.2 Initiate action to establish secondary containment boundary.	Immediately
	AND	
	D.3 Initiate action to isolate each secondary containment penetration flow path or verify it can be manually isolated from the control room.	Immediately
	AND	
	D.4 Initiate action to verify one standby gas treatment subsystem is capable of being placed in operation.	Immediately
E. Required Action and associated Completion Time of Condition C or D not met. OR DRAIN TIME < 1 hour.	E.1 Initiate action to restore DRAIN TIME to ≥ 36 hours.	Immediately

The proposed SRs for TS 3.5.2 are shown below:

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.2.1	Verify DRAIN TIME ≥ 36 hours.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.2	Verify, for the required ECCS injection/spray subsystem, the: a. Suppression pool water level is ≥ 8.5 ft; or b. Contaminated condensate storage tank(s) water volume is ≥ 140,000 available gallons.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.3	Verify, for the required ECCS injection/spray subsystem, locations susceptible to gas accumulation are sufficiently filler with water.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.4	----------NOTE---------- Not required to be met for system vent flow paths opened under administrative control. ---------- Verify, for the required ECCS injection/spray subsystem, each manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.5	Operate the required ECCS injection/spray subsystem through the recirculation line for ≥ 10 minutes.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.6	Verify each valve credited for automatically isolating a penetration flow path actuates to the isolation position on an actual or simulated isolation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.7	----------NOTE---------- Vessel injection/spray may be excluded. ---------- Verify the required ECCS injection/spray subsystem can be manually operated.	In accordance with the Surveillance Frequency Control Program

2.2.4 Deletion of Reference to OPDRVs Term

The licensee proposed to delete references to OPDRVs (or terms related to OPDRVs) throughout the QCNPS TSs because the term "OPDRVs" will no longer being used. These affected TS either (1) contain one or more OPDRVs references, such as, the conditional applicability "during operations with a potential for draining the reactor vessel (OPDRVs)," or (2) if certain conditions are not met, the required actions direct the licensee to "initiate action to suspend operations with a potential for draining the reactor vessel (OPDRVs)." The following table lists these TSs and their affected sections.

QCNPS TS	Location of OPDRVs Reference
3.3.6.1, Primary Containment Isolation Instrumentation	Table 3.3.6.1-1 Footnote (b) is deleted
3.3.6.2, Secondary Containment Isolation Instrumentation	Table 3.3.6.2-1 Footnote (a) is deleted Footnote (b) is designated as (a)
3.3.7.1, Control Room Emergency Ventilation (CREV) System Isolation Instrumentation	Table 3.3.7.1-1 Footnote (a) is deleted Footnotes (b) and (c) are designated as (a) and (b), respectively
3.6.1.3, Primary Containment Isolation Valves (PCIVs)	Condition F, Required Actions F.1 and F.2 are deleted
3.6.4.1, Secondary Containment	Applicability, Condition C, Required Action C.2 are revised to delete the term or phrase containing OPDRVs
3.6.4.2, Secondary Containment Isolation Valves (SCIVs)	Applicability, Condition D, Required Action D.2 are revised to delete the term or phrase containing OPDRVs
3.6.4.3, Standby Gas Treatment (SGT) System	Applicability, Conditions C and F, Required Actions C.2.2 and F.2 are revised to delete the term or phrase containing OPDRVs
3.7.4, Control Room Emergency Ventilation (CREV) System	Applicability, Condition E, Required Action E.2 are revised to delete the term or phrase containing OPDRVs
3.7.5, Control Room Emergency Ventilation Air Conditioning (AC) System	Applicability, Condition C, Required Action C.2 are revised to delete the term or phrase containing OPDRVs
3.8.2, AC Sources - Shutdown	Required Actions A.2.3 and B.3 are deleted Existing Required Action A.2.4 is designated as A.2.3 Existing Required Action B.4 is designated as B.3
3.8.5, DC Sources - Shutdown	Required Action A.2.3 is deleted Existing Required Action A.2.4 is designated as A.2.3
3.8.8, Distribution Systems - Shutdown	Required Action A.2.3 is deleted Existing Required Actions A.2.4 and A.2.5 are designated as A.2.3 and A.2.4, respectively

2.2.5 QCNPS Plant-Specific TSTF-542 Variations

In Attachment 1, Section 2.2 of the license amendment request (LAR), and in the supplemental letter dated September 27, 2018, the licensee identified several QCNPS plant-specific TS

variations from TSTF-542, Revision 2, or the NRC-approved TSTF-542 SE. The licensee stated these variations do not affect the applicability of TSTF-542 or the NRC staff's SE to the proposed license amendment. Section 3.5 of this SE includes the staff's evaluation for each variations.

2.2.5.1 Variation 1, TS Table 3.3.5.2-1, Footnote (a) Missing from Two Functions

In accordance with TSTF-542, TS Table 3.3.5.2-1, Function 1.a (Core Spray System Reactor Steam Dome Pressure - Low (Injection Permissive), and Function 2.a (Low Pressure Coolant Injection (LPCI) Reactor Steam Dome Pressure - Low (Injection Permissive) are required in Modes 4 and 5. Prior to TSTF-542, the analogous Functions 1.c and 2.c in TS Table 3.3.5.1-1 had a Modes 4 and 5 applicability modified by a footnote specifying that these functions were only required when the associated ECCS subsystem(s) were required to be operable per LCO 3.5.2, "ECCS Shutdown." The licensee stated that the footnote was inadvertently omitted from Table 3.3.5.2-1 Functions 1.a and 2.a in TSTF-542.

A variation is proposed to affix Footnote (a) (i.e., "Associated with an ECCS subsystem required to be OPERABLE by LCO 3.5.2, 'Reactor Pressure Vessel Water Inventory Control'") to the "Required Channels Per Function" column of Functions 1.a and 2.a of TS Table 3.3.5.2-1.

2.2.5.2 Variation 2, TS Table 3.3.5.1-1, Time Delays for CS and LPCI

There are QCNPS specific instrumentation functions that differ from the NUREG-1433, "Standard Technical Specifications [STS], General Electric BWR/4 Plants," Volume 1, Revision 4.0, (ADAMS Accession No. ML12104A192). The licensee stated that changes to these instrumentation functions are justified by the discussion in Section 3.4.1 of the TSTF-542 justification. Specifically, QCNPS TS Table 3.3.5.1-1, Functions 1.e and 2.e describe pump start time delay relays for the core spray (CS) and low pressure coolant injection (LPCI) pumps. The licensee proposes to remove these Functions from the TS because the required ECCS subsystem would be started by manual operation.

2.2.5.3 Variation 3, TS Table 3.3.5.2-1 Channel Checks

The QCNPS does not currently have the capability to perform Channel Checks for proposed TS Table 3.3.5.2-1, Functions 1.a, "Reactor Steam Dome Pressure - Low (Permissive), 1.b, "Core Spray Pump Discharge Flow - Low (Bypass)," 2.a, "Reactor Steam Dome Pressure - Low (Permissive)," and 2.b, "Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)." The licensee stated that the current QCNPS TSs do not include Channel Checks for these functions; therefore, no Channel Check SR was added for these functions.

2.2.5.4 Variation 4, LPCI Channel per Loop Versus Channel per Pump

Each unit has two LPCI loops with two pumps in each loop (i.e., four LPCI pumps per unit). The QCNPS TSs currently require one operable channel for each LPCI loop for the "Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)" Function. The licensee proposes to maintain the one channel per loop for Technical Specification 3.3.5.2, Table 3.3.5.2-1, Function 2.b in lieu of one channel per pump as described in the STS. This is because at QCNPS there is only one flow transmitter for each loop that monitors the flow of both pumps in that loop (i.e., two LPCI loop flow transmitters per unit).

2.2.5.5 Variation 5, CS and LPCI Manual Initiation Logic

The current QCNPS TSs do not include a manual initiation logic function for the CS or LPCI subsystems. Therefore, since this function does not exist at QCNPS, the licensee did not include manual initiation functions for LPCI and CS in TS 3.3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control," Table 3.3.5.2-1. Additionally, the licensee stated that since the manual initiation functions are not included in Table 3.3.5.2-1, the associated Logic System Functional Test would likewise not be required for TS 3.3.5.2; therefore, TS 3.3.5.2, as proposed for QCNPS, does not include a Logic System Functional Test SR.

2.2.5.6 Variation 6, RWCU and RHR/SDC Channel Inputs

The automatic isolation on Reactor Vessel Water Level - Low functions for the RWCU and residual heat removal shutdown cooling (RHR SDC) systems at QCNPS varies slightly from the system described in the STS. These functions receive input from four reactor vessel water level channels. Each channel inputs into one of four trip strings, and two trip strings make up a trip system. The trip systems are aligned in a parallel configuration, so both trip systems must trip in order to cause an isolation of the RWCU or RHR SDC system valves. Any channel will trip its associated trip string and trip system. Therefore, both trip systems with one trip string in each trip system is required to provide for automatic RWCU and RHR SDC system isolation. The licensee revised proposed TS Table 3.3.5.2-1 to reflect the QCNPS requirement for one operable channel in each Reactor Vessel Water Level - Low isolation trip system for RWCU and RHR SDC.

2.2.5.7 Variation 7, TS LCO 3.5.2 Note

The QCNPS TSs do not currently contain a Note applicable to LCO 3.5.2 that allows a LPCI subsystem to be considered operable when aligned for decay heat removal. Instead, this Note is currently associated with existing SR 3.5.2.3 (i.e., proposed SR 3.5.2.4). The proposed QCNPS TS 3.5.2 includes this Note to align with the STS. The licensee stated that this is a minor variation, as the purpose of the Note is the same as the one described in the STS and the Note is applicable to QCNPS.

2.2.5.8 Variation 8, Suppression Pool and Contaminated Condensate Storage Tank

At QCNPS, verification of suppression pool and contaminated condensate storage tank volumes is contained in a single SR (i.e., existing SR 3.5.2.1 and proposed SR 3.5.2.2) versus in separate SRs as found in the STS. The licensee stated that this does not affect the applicability of TSTF-542.

2.2.5.9 Variation 9, TS 3.6.1.3, Condition F

The licensee proposes to delete QCNPS TS 3.6.1.3, "Primary Containment Isolation Valves (PCIVs)"; Condition F and all of its associated Required Actions. The Applicability for TS 3.6.1.3 is Modes 1, 2, and 3, and "When associated instrumentation is required to be OPERABLE per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation."" The licensee stated that this change is justified since OPDRV requirements have been deleted, and Mode 4 and 5 PCIV requirements have been relocated from TS 3.3.6.1 and 3.6.1.3 to the proposed TS 3.3.5.2.

2.2.5.10 Variation 10, Deletion of SR 3.8.2.1 Note 2

In the supplemental letter dated September 27, 2018, the licensee proposed to modify TS 3.8.2, "AC Sources-Shutdown," SR 3.8.2.1. Specifically, the licensee proposed to delete Note 2 from SR 3.8.2.1. Note 2 states:

> SR 3.8.1.13 and SR 3.8.1.19 are not required to be met when associated ECCS subsystem(s) are not required to be OPERABLE per LCO 3.5.2, "ECCS-Shutdown."

Currently, SR 3.8.2.1 requires that all of the SRs of TS 3.8.1 be met, with some listed exceptions. The licensee additionally proposed to add SRs 3.8.1.13 and 3.8.1.19 to this list of exceptions in SR 3.8.2.1.

2.3 Applicable Regulatory Requirements and Guidance

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.36(a)(1), requires an applicant for an operating license to include in the application proposed TSs in accordance with the requirements of 10 CFR 50.36. The applicant must also include in the application, a "summary statement of the bases or reasons for such specifications, other than those covering administrative controls." However, per 10 CFR 50.36(a)(1), these TS bases "shall not become part of the technical specifications."

As required by 10 CFR 50.36(c)(1)(i)(A), TSs will include:

> (1) *Safety limits, limiting safety system settings, and limiting control settings.*
> (i)(A) Safety limits for nuclear reactors are limits upon important process variables that are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity. If any safety limit is exceeded, the reactor must be shut down. The licensee shall notify the Commission, review the matter, and record the results of the review, including the cause of the condition and the basis for corrective action taken to preclude recurrence. Operation must not be resumed until authorized by the Commission.

As required by 10 CFR 50.36(c)(2)(i), the TSs will include LCOs, which are the lowest functional capability or performance levels of equipment required for safe operation of the facility. Per 10 CFR 50.36(c)(2)(i), when an LCO of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the TSs until the condition can be met.

The regulation at 10 CFR 50.36(c)(2)(ii) requires licensees to establish TS LCOs for items meeting one or more of the listed criteria. Criterion 4, "A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety," supports the establishment of LCOs for RPV WIC due to insights gained via operating experience.

The regulation at 10 CFR 50.36(c)(3) requires TSs to include SRs, which are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the LCOs will be met.

The regulation at 10 CFR 50.57 states that an operating license may be issued by the Commission upon finding that, among other things, there is reasonable assurance that the activities authorized by the operating license can be conducted without endangering the health and safety of the public, and that such activities will be conducted in compliance with the regulations.

Pursuant to 10 CFR 50.90, whenever a holder of an operating license desires to amend the license, an application for an amendment must be filed with the Commission fully describing the changes desired, and following as far as applicable, the form prescribed for original applications. The technical information to be included in an application for an operating license is specified by 10 CFR 50.34(b).

As described in 10 CFR 50.92(a), in determining whether an amendment to a license will be issued to the applicant, the Commission will be guided by the considerations which govern the issuance of initial licenses to the extent applicable and appropriate. The general considerations that guide the Commission include, as stated in 10 CFR 50.40(a), are that the TSs provide reasonable assurance that the health and safety of the public will not be endangered, and as stated in 50.40(d), that applicable requirements of 10 CFR Part 51 have been satisfied.

As stated in the Commission Policy on Technical Specifications Improvements for Nuclear Power Reactors (58 FR 39132, dated July 22, 1993), the Commission encourages licensees to use the improved STS as the basis for plant-specific TSs.

Volumes 1 and 2 of NUREG-1433, Revision 4 (ADAMS Accession Nos. ML12104A192 and ML12104A193), contain the STSs and Bases for BWR/4 plants; and as part of the regulatory standardization effort, the NRC staff has prepared STSs for each of the light-water reactor nuclear designs.

The NRC staff's guidance for review of TSs is in Chapter 16, "Technical Specifications," of NUREG-0800, Revision 3, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP), dated March 2010 (ADAMS Accession No. ML100351425).

2.3.1 QCNPS Applicable Regulatory Design Requirements

Section 3.1, "Compliance with NRC General Design Criteria," of the QCNPS Updated Final Safety Analysis Report (UFSAR) describes an evaluation of the proposed general design criteria (GDC) (issued July 1967)[3] which were used by the Atomic Energy Commission to evaluate the original design of QCNPS station. The following criteria from the QCNPS UFSAR are related to this LAR:

Criterion 9 – "Reactor Coolant Pressure Boundary." The reactor coolant pressure boundary [RCPB] shall be designed and constructed so as to have an exceedingly low probability of gross rupture or significant leakage throughout its design lifetime.

Criterion 12 – "Instrumentation and Control Systems." Instrumentation and controls shall be provided as required to monitor and maintain variables within prescribed operating ranges.

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[3] Published on July 11, 1967 (32 FR 10213). Also available in ADAMS at Accession No. ML043310029.

Criterion 13 – "Fission Process Monitors and Controls." Means shall be provided for monitoring and maintaining control over the fission process throughout core life and for all conditions that can be reasonably be anticipated to cause variations in reactivity of the core, such as indication of position of control rods and concentration of soluble reactivity control poisons.

Criterion 16 – "Monitoring Reactor Coolant Pressure Boundary." Means shall be provided for monitoring the RCPB to detect leakage.

Criterion 33 – "Reactor Coolant Pressure Boundary Capability." The RCPB shall be capable of accommodating without rupture, and with only limited allowance for energy absorption through plastic deformation, the static and dynamic loads imposed on any boundary component as a result of any inadvertent and sudden release of energy to the coolant. As a design reference, this sudden release shall be taken as that which would result from a sudden reactivity insertion such as a rod ejection (unless prevented by positive mechanical means), rod dropout, or cold water addition.

Criterion 37 – "Engineered Safety Features (ESF) Basis for Design." Engineered safety features shall be provided in the facility to back up the safety provided by the core design, the RCPB, and their protection systems. As a minimum, such ESFs shall be designed to cope with any size RCPB break up to and including the circumferential rupture of any pipe in that boundary assuming unobstructed discharge from both ends.

Criterion 41 – "ESF Performance Capability." ESFs such as emergency core cooling and containment heat removal systems shall provide sufficient performance capability to accommodate partial loss of installed capacity and still fulfill the required safety function. As a minimum, each ESF shall provide this required safety function assuming a failure of a single active component.

Criterion 44 – "Emergency Core Cooling System Capability." At least two emergency core cooling systems, preferably of different design principles, each with a capability for accomplishing abundant emergency core cooling, shall be provided. Each emergency core cooling system and the core shall be designed to prevent fuel and clad damage that would interfere with the emergency core cooling function and to limit the clad metal-water reaction to negligible amounts for all sizes of breaks in the RCPB, including the double-ended rupture of the largest pipe. The performance of each emergency core cooling system shall be evaluated conservatively in each area of uncertainty. The systems shall not share active components and shall not share other features or components unless it can be demonstrated that (a) the capability of the shared feature or component to perform its required function can be readily ascertained during reactor operation, (b) failure of the shared feature or component does not initiate a loss-of-coolant accident, and (c) capability of the shared feature or component to perform its required function is not impaired by the effects of a LOCA and is not lost during the entire period this function is required following the accident.

3.0 TECHNICAL EVALUATION

Section 2.2 above lists proposed TS changes, as described in the LAR and the supplement, for the licensee to adopt TSTF-542, Revision 2. The following sections summarize the NRC staff's evaluation of each of these proposed changes.

3.1 Staff Evaluation of Proposed Addition of New DRAIN TIME Definition

As discussed in Section 2.2.1 above, the DRAIN TIME is the time it would take the RPV water inventory to drain from the current level to the TAF assuming the most limiting of the RPV penetrations flow paths with the largest flow rate, or a combination of penetration flow paths that could open due to a common mode failure, were to open and the licensee took no mitigating action.

The NRC staff reviewed the proposed DRAIN TIME definition from TSTF-542, Revision 2. For its review, the staff considers a "break" to be a pathway for water to drain from the RPV that has not been prescribed in the "DRAIN TIME" definition in TSTF-542, Revision 2. Based on information furnished by the licensee, the NRC staff determined that the licensee proposes to adopt the same DRAIN TIME definition specified in TSTF-542, Revision 2.

With the adoption of the DRAIN TIME definition in accordance with TSTF-542, it is expected that all RPV penetrations below the TAF will be included in the determination of DRAIN TIME as potential pathways. As part of this evaluation, the NRC staff reviewed responses to requests for additional information (ADAMS Accession No. ML16074A448) that the NRC staff considered to approve TSTF-542, Revision 2. Examples of bounding DRAIN TIME calculations for three examples were provided: (1) water level at or below the RPV flange; (2) water level above RPV flange with fuel pool gates installed, and; (3) water level above RPV flange with fuel pool gates removed. The DRAIN TIME is calculated by taking the water inventory above the break and dividing by the limiting drain rate until the TAF is reached. The limiting drain rate is a variable parameter depending on the break size and the reduction of elevation head above break location during the drain down event. The discharge point will depend on the lowest potential drain point for each RPV penetration flow path on a plant-specific basis. This calculation provides a conservative approach to determining the DRAIN TIME of the RPV, thereby, protecting Safety Limit 2.1.1.3, which meets the requirements of 10 CFR 50.36(c)(3). Therefore, the NRC staff finds that the licensee's proposed addition of the DRAIN TIME definition to the QCNPS TSs is acceptable.

3.2 Staff Evaluation of Proposed TS 3.3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control Instrumentation"

The purpose of the proposed new TS 3.3.5.2 regarding RPV WIC instrumentation is to support the requirements of revised TS LCO 3.5.2, and the proposed new definition of DRAIN TIME. There are instrumentation and controls that are required for manual pump starts or required as a permissive or operational controls on the equipment of the systems that provide water injection capability, certain start commands, pump protection, and isolation functions. These instruments are required to be operable if the systems that provide water injection and isolation functions are to be considered operable, as described in Section 3.3 of this SE for revised TS 3.5.2.

For QCNPS, reactor operators have alternate means, often involving several more steps to start and inject water than the preferred simple push button start, but these actions can still be accomplished within the time frames assumed in the development of TSTF-542. Specifically, the proposed new TS 3.3.5.2 supports operation of the CS and LPCI including manual starts when needed, as well as the system isolation of the RHR system and the RWCU system. The equipment involved with each of these systems is described in the evaluation of TS 3.5.2 and the Bases for TS 3.5.2. The following sections evaluate the various parts of the new TS 3.3.5.2.

3.2.1 Staff Evaluation of Proposed TS 3.3.5.2 Limiting Condition for Operation and Applicability

In the LAR, the licensee proposed a new TS 3.3.5.2 to provide alternative instrumentation requirements to support manual initiation of the ECCS injection/spray subsystem and for automatic isolation of penetration flow paths that may be credited in the determination of DRAIN TIME. The current TSs contain instrumentation requirements related to OPDRVs in TS Tables 3.3.5.1-1, 3.3.6.1-1, 3.3.6.2-1, and 3.3.7.1-1. The requirements from Tables 3.3.5.1-1 and 3.3.6.1-1 would be consolidated into new TS Table 3.3.5.2-1. The references to OPDRV requirements in Tables 3.3.6.1-1, 3.3.6.2-1, and 3.3.7.1-1 would be deleted, as discussed in Section 3.6 of this safety evaluation.

The proposed LCO 3.3.5.2 would state: "The RPV Water Inventory Control instrumentation for each Function in Table 3.3.5.2-1 shall be OPERABLE."

The proposed Applicability would state: "According to Table 3.3.5.2-1."

The TSTF-542, Revision 2, selected Table 3.3.5.2-1 to contain those instrumentation Functions needed to support manual initiation of the ECCS injection/spray subsystem required by LCO 3.5.2, and for automatic isolation of penetration flow paths that may be credited in a calculation of DRAIN TIME. Creation of TS 3.3.5.2 places these Functions in a single location with requirements appropriate to support the safety function for TS 3.5.2. The TSTF states that if the plant-specific design and TSs require different functions to support manual initiation of an ECCS subsystem, those functions should be included in TS 3.3.5.2.

The NRC staff concludes that the licensee's proposed revision is acceptable for QCNPS because either the CS or LPCI (or both) subsystems would be available to perform the intended function to inject water into the RPV; therefore, this meets the intent of the NRC-approved TSTF-542, Revision 2.

3.2.2 Staff Evaluation of Proposed TS 3.3.5.2 Actions

Section 2.2.2.2 of this SE lists the licensee's proposed new TS 3.3.5.2 Actions. The NRC staff reviewed Actions A through E to determine whether they provide effective remedial measures when one or more instrument channels are inoperable and cannot complete the required function in the normal manner.

Action A would be applicable when one or more instrument channels are inoperable from Table 3.3.5.2-1 and directs the licensee to immediately enter the Condition referenced in Table 3.3.5.2-1 for that channel.

Action B (concerning the RHR/SDC system isolation and RWCU system isolation Functions) would be applicable when automatic isolation of the associated penetration flow path is credited as a path for potential drainage in calculating DRAIN TIME. If the instrumentation is inoperable, Required Action B.1 directs an immediate declaration that the associated penetration flow path(s) are incapable of automatic isolation. Required Action B.2 requires an immediate re-calculation of DRAIN TIME, but automatic isolation of the affected penetration flow paths cannot be credited.

Action C (concerning low reactor steam dome pressure permissive functions necessary for ECCS subsystem manual injection valve opening) would address an event in which the

permissive is inoperable. The function must be placed in trip condition within 1 hour. With the permissive function instrument in the trip condition, the manual injection valve can be opened using the preferred control board switches. The 1-hour completion time is acceptable, because despite the preferred start method being prevented, the reactor operator can take manual control of the pump and the injection valve to inject water into the RPV and achieve the safety function in that time. The time of 1 hour also provides reasonable time for the operators to place the channel in trip.

Action D (concerning pump discharge flow bypass functions) would address when the bypass is inoperable and there is a possible risk that the associated ECCS pump could overheat when the pump is operating and the associated injection valve is not fully open. In this condition, the operator can take manual control of the pump and the injection valve. Similar to justification in Action C, while this is not the preferred method, the CS and LPCI subsystem pumps can be started manually and the valves can be opened manually. The 24-hour completion time is acceptable, because the functions can be performed manually and it allows time for the operator to evaluate and have necessary repairs completed.

Action E becomes necessary if the Required Actions and associated Completion Times of Conditions C or D were not met. If they were not met, then the associated low pressure ECCS injection/spray subsystem might be incapable of performing the intended function, and the CS/LPCI subsystem would be declared inoperable immediately.

These Actions direct the licensee to take appropriate actions and enter into the Conditions referenced in Table 3.3.5.2-1. The NRC staff concludes that proposed Actions A through E satisfy the requirements of 10 CFR 50.36(c)(2)(i) by providing remedial actions permitted by the TSs until the LCO can be met. In addition, proposed Actions A through E provide reasonable assurance that the licensee will take appropriate actions during an unexpected drain event to either prevent or to mitigate the RPV water level being lowered to the TAF. Because this satisfies the requirement of 10 CFR 50.57(a)(3)(i), the NRC staff finds that the proposed actions are acceptable.

3.2.3 Staff Evaluation of Proposed TS 3.3.5.2 Surveillance Requirements

The proposed new TS 3.3.5.2 SRs include Channel Checks and Channel Functional Tests numbered SR 3.3.5.2.1 and SR 3.3.5.2.2, respectively.

SR 3.3.5.2.1 would require a Channel Check and applies to system isolation functions in TS Table 3.3.5.2-1 for RHR/SDC isolation and RWCU system isolation. Performance of the Channel Check would ensure that a failure of the instrumentation has not occurred. A Channel Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other related channels. A Channel Check is significant in assuring that there is a low probability of an undetected complete channel failure and is a key safety practice to verifying the instrumentation continues to operate properly between each Channel Functional Test. The frequency would be in accordance with the Surveillance Frequency Control Program, which is consistent with the existing requirements and supports operating shift situational awareness.

SR 3.3.5.2.2 would require a Channel Functional test and applies to all functions in TS Table 3.3.5.2-1. A Channel Functional test is the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify operability of all devices in the channel required for channel operability. It would be performed on each required channel to

ensure that the entire channel will perform the intended function. The frequency would be in accordance with the Surveillance Frequency Control Program (SFCP). The NRC staff finds that this is acceptable because it is consistent with the existing requirements for these Functions and is based upon operating experience that demonstrates channel failure is rare. In addition, this SR could be included as part of a refueling activity since during refueling outages periods in Modes 4 and 5 are often 30 days or less.

The TSTF-542 does not include SRs to verify or adjust the instrument setpoint derived from the allowable value using a Channel Calibration, or a surveillance to calibrate the trip unit (setpoint). This is because a draining event in Modes 4 or 5 is not an analyzed accident and, therefore, there is no accident analysis on which to base the calculation of a setpoint. The purpose of the TS 3.3.5.2 Functions is to allow ECCS injection/spray manual initiation or to automatically isolate a penetration flow path, but no specific RPV water level is assumed for those actions. Therefore, the allowable value for Mode 3 was chosen for use in Modes 4 and 5 as it will perform the desired function. Calibrating the Functions in Modes 4 and 5 is not necessary, as TS 3.3.5.1 and TS 3.3.6.1 continue to require the Functions to be calibrated on an established interval. The NRC staff concludes that the Mode 3 allowable value and established calibration intervals are adequate to ensure the channel will respond with the required accuracy to allow manual initiation of the pumping systems to inject water and automatic isolation of penetration flow paths.

The NRC staff finds that these tests are sufficient and adequate because they will ensure the Functions of TS 3.3.5.2 are operable (i.e., capable of performing the specified safety function in support of TS 3.5.2, DRAIN TIME, and the protection from a potential drain down of the RPV in Modes 4 and 5). The NRC staff finds that the proposed SRs are acceptable and concludes that these SRs satisfy 10 CFR 50.36(c)(3) by providing the specific SRs relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, and that LCO 3.3.5.2 will be met.

3.2.4 Staff Evaluation of Proposed TS Table 3.3.5.2-1, "RPV Water Inventory Control Instrumentation"

In order to support the requirements of the proposed TS 3.5.2, the associated instrumentation requirements are designated in Table 3.3.5.2-1. These instruments would be required to be operable if the systems that provide water injection and isolation functions were to be considered operable as described in the NRC staff's evaluation of TS 3.5.2 (Section 3.3 of this SE).

The NRC staff finds this table acceptable because it sufficiently identifies the functions, the applicability, the number of required channels, the references to the Condition to be entered by letter (e.g., A, B, C) if the function is inoperable, the applicable SRs, the allowable value for each trip function, and the associated footnotes.

Each of the low pressure ECCS subsystems in Modes 4 and 5 can be started by manual alignment of a small number of components. Automatic initiation of an ECCS injection/spray subsystem may be undesirable because it could lead to overflowing the RPV cavity, due to injection rates of thousands of gallons per minute. Thus, manual actuation is preferable and there is adequate time to take manual actions (e.g., hours versus minutes). Considering the action statements as the DRAIN TIME decreases (the proposed TS 3.5.2, Action E, prohibits plant conditions that could result in drain times less than one hour), there is sufficient time for the reactor operators to perform manual action to stop the draining event, and to manually start

an ECCS injection/spray subsystem or additional method of water injection as needed. Consequently, there is no need for automatic initiation of the ECCS to respond to an unexpected draining event. The NRC staff finds this acceptable, because a draining event is slower than a design basis LOCA assumed to occur at a significant power level.

The NRC staff finds this RPV WIC instrumentation set is acceptable, because it is adequate so that the instrument channels respond with the required accuracy permitting pump systems to inject water when needed, and activating isolation equipment when commanded to support prevention or mitigation of a potential RPV draining event.

3.2.4.1 Staff Evaluation of Proposed Table 3.3.5.2-1 Functions

Functions 1.a and 2.a in proposed TS Table 3.3.5.2-1, are Reactor Steam Dome Pressure - Low (Permissive), for CS and LPCI, respectively. They are used as injection permissives for the low pressure ECCS subsystems. This ensures that, prior to opening the injection valves of the low pressure ECCS subsystems, the reactor pressure has fallen to a value below these subsystems maximum design pressure. While it is assured during Modes 4 and 5 that the reactor steam dome pressure will be below the ECCS maximum design pressure, the Reactor Steam Dome Pressure - Low signals are assumed to be operable and capable of permitting manual operation of the required ECCS subsystem from the control room.

The Reactor Steam Dome Pressure - Low (Permissive) signals are initiated from two pressure switches that sense the reactor steam dome pressure. The allowable value is low enough to prevent overpressurizing the equipment in the low pressure ECCS. Two channels of Reactor Steam Dome Pressure - Low (Permissive) are only required to be Operable in Modes 4 and 5 when the associated ECCS subsystem is required to be Operable by LCO 3.5.2. The proposed allowable value would be ≤ 342 pounds per square inch gauge (psig), with two required channels per function, as it is currently in QCNPS TS Table 3.3.5.1-1.

The instruments for Table 3.3.5.2-1 includes Functions 1.b (CS) and 2.b (LPCI), Pump Discharge Flow - Low (Bypass). These minimum flow instruments are provided to protect the associated low pressure ECCS pump from overheating when the pump is operating and the associated injection valve is not sufficiently open. The minimum flow line valve is opened when low flow is sensed, and the valve is automatically closed when the flow rate is adequate to protect the pump.

One flow transmitter per CS pump and one flow transmitter per LPCI loop are used to detect the associated subsystems' flow rates. The logic is arranged such that each transmitter causes its associated minimum flow valve to open when flow is low with the pump running. The logic will close the minimum flow valve once the closure setpoint is exceeded. The Pump Discharge Flow - Low (Bypass) allowable values are high enough to ensure that the pump flow rate is sufficient to protect the pump. The Core Spray Discharge Flow - Low (Bypass) allowable value is also low enough to ensure that the closure of the minimum flow valve is initiated to allow full flow into the core. For LPCI, the closure of the minimum flow valves is not credited.

Each channel of Pump Discharge Flow - Low (Bypass) Function is only required to be operable in Modes 4 and 5 when the associated ECCS subsystem is required to be operable by LCO 3.5.2 to ensure the pumps are capable of injecting into the RPV when manually operated from the control room.

The proposed allowable values for Functions 1.b and 2.b are as follows (moved from QCNPS TS Table 3.3.5.1-1):

CS ≥ 577 gpm [gallons per minute] and ≤ 830 gpm
LPCI ≥ 2526 gpm

For Table 3.3.5.2-1, Function 3.a, RHR Shutdown Cooling System (SDC) Isolation, Reactor Vessel Water Level - Low, the function would only be required to be operable when automatic isolation of the associated penetration flow path is credited in the DRAIN TIME calculation. The proposed number of required instrument channels is one per trip system, which retains the requirement specified in existing TS Table 3.3.6.1-1 footnote (b) which states,

> In MODES 4 and 5, provided RHR Shutdown Cooling System integrity is maintained, only one channel per trip system with an isolation signal available to one shutdown cooling pump suction isolation valve is required.

The condition that the SDC system integrity be maintained is a concept related to OPDRVs, so it would not be carried over into TS 3.3.5.2 for RPV WIC instrumentation.

The Reactor Vessel Water Level - Low Function receives input from four reactor vessel water level channels. Each channel inputs into a trip string. There are two trip systems, each having two trip strings. In order to cause an isolation of the SDC, the trip systems require a logic of one-out-of-two-taken twice (i.e., at least one tripped string in each trip system).

The Reactor Vessel Water Level - Low Allowable Value was chosen to be the same as the Primary Containment Isolation Instrumentation Reactor Vessel Water Level-Low Allowable Value (LCO 3.3.6.1), since the capability to cool the fuel may be threatened (≥ 3.8 inches).

For Table 3.3.5.2-1, Function 4.a, RWCU system isolation, Reactor Vessel Water Level - Low, the function is only required to be operable when automatic isolation of the associated penetration flow path is credited in the DRAIN TIME calculation. The proposed number of required channels is one per trip system.

The Reactor Vessel Water Level - Low Isolation Function receives input from four reactor vessel water level channels. Each channel inputs into a trip string. There are two trip systems, each having two trip strings. In order to cause an isolation of the RWCU, the trip systems require a logic of one-out-of-two-taken twice (i.e., at least one tripped string in each trip system). This is further evaluated in Section 3.7.6 of this SE (Variation 6).

3.2.5 Staff Conclusion for Proposed TS 3.3.5.2

The NRC staff reviewed the proposed addition of TS 3.3.5.2 and finds it acceptable based on the actions that will be taken to ensure that the RPV WIC instrumentation will be operable. TS LCO 3.3.5.2 correctly specifies the lowest functional capability or performance levels of equipment required for safe operation of the facility. The TS provides reasonable assurance that the required actions to be taken when the LCO is not met can be conducted without endangering the health and safety of the public. Therefore, the staff finds that the proposed LCO 3.3.5.2 meets the requirements of 10 CFR 50.36(c)(2) and 50.57(a)(3)(i).

3.3 Staff Evaluation of TS 3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control"

The NRC staff reviewed the water sources that would be applicable to the proposed TS 3.5.2.

The proposed LCO 3.5.2 would state, in part: "One low pressure ECCS injection/spray subsystem shall be OPERABLE."

"One" low pressure ECCS injection/spray subsystem would consist of either one CS subsystem or one LPCI subsystem. A CS subsystem consists of one motor driven pump, piping, and valves to transfer water from the suppression pool or contaminated condensate storage tanks to the RPV. An LPCI subsystem consists of one motor driven pump, piping, and valves to transfer water from the suppression pool or contaminated condensate storage tanks to the RPV. Each QCNPS unit has a total of two CS pumps and four LPCI pumps as described in UFSAR Table 6.3-2, "Emergency Core Cooling System."

The ECCS pumps are high-capacity pumps with flow rates of thousands of gallons per minute (gpm). Most RPV penetration flow paths would have a drain rate on the order of tens or hundreds of gpm. The manual initiation/start of an ECCS pump would provide the necessary water source to counter these expected drain rates. The LPCI subsystem is considered to be operable to perform its safety function while it is aligned and operating for decay heat removal if it is capable of being manually realigned. Decay heat removal in Modes 4 and 5 is not affected by the proposed QCNPS TS change because the requirements on the number of shutdown cooling subsystems that must be operable to ensure adequate decay heat removal from the core are unchanged. These requirements can be found in the QCNPS TS 3.4.8, "Residual Heat Removal (RHR) Shutdown Cooling System - Cold Shutdown," TS 3.9.8, "Residual Heat Removal (RHR) - High Water Level," and TS 3.9.9, "Residual Heat Removal (RHR) - Low Water Level." Based on these considerations, the NRC staff finds that the water sources requirements provide reasonable assurance that the lowest functional capability required for safe operation is maintained and the safety limit is protected.

The proposed TS LCO 3.5.2 contains two parts. The first part states that DRAIN TIME of RPV water inventory to the TAF shall be ≥ 36 hours, and the second part states that one low pressure ECCS injection/spray subsystem shall be Operable. The proposed applicability for TS 3.5.2 is Modes 4 and 5. The proposed LCO 3.5.2 Note states:

> A Low Pressure Coolant Injection (LPCI) subsystem may be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned and not otherwise inoperable.

The NRC staff reviewed the proposed TS 3.5.2, focusing on ensuring that the fuel remains covered with water and on the proposed changes to the current TS. The proposed TS 3.5.2 contains Conditions A through E that are based on either required ECCS injection/spray subsystem operability or DRAIN TIME.

The current TS LCO states that two low pressure ECCS injection/spray subsystems shall be operable, whereas the proposed LCO 3.5.2 states that one low pressure ECCS injection/spray subsystem shall be operable. This change is reflected in Condition A. The change from two low pressure ECCS injection/spray subsystems to one low pressure ECCS injection/spray subsystem is because this redundancy is not required. The NRC staff previously determined that with one ECCS injection/spray subsystem and non-safety related injection sources, defense-in-depth will be maintained (ADAMS Accession No. ML16343B008). The defense-in-

depth measure is consistent with other events considered during shutdown with no additional single failure assumed. The DRAIN TIME controls, in addition to the required ECCS injection/spray subsystem, provide reasonable assurance that an unexpected draining event can be prevented or mitigated before the RPV water level would be lowered to the TAF.

The proposed Applicability of TS 3.5.2 to Modes 4 and 5 is appropriate because TS requirements for ECCS instrumentation in Modes 1, 2, and 3 will still exist in TS 3.3.5.1.

The proposed Condition A states that if the required ECCS injection/spray subsystem is inoperable, it is to be restored to operable status within 4 hours.

The proposed Condition B states that if Condition A is not met, a method of water injection capable of operating without offsite electrical power shall be established immediately. The proposed Condition B provides adequate assurance of an available water source should Condition A not be met within the 4-hour completion time.

The proposed Condition C states that for a DRAIN TIME < 36 hours and ≥ 8 hours, to (1) verify the secondary containment boundary is capable of being established in less than the DRAIN TIME with a completion time of 4 hours, and (2) verify each secondary containment penetration flow path is capable of being isolated less than the DRAIN TIME with a completion time of 4 hours, and (3) verify one standby gas treatment subsystem is capable of being placed in operation in less than the DRAIN TIME with a completion time of 4 hours. The proposed Condition C provides adequate protection should the DRAIN TIME be < 36 hours and ≥ 8 hours because of the ability to establish secondary containment, isolate additional flow paths, and have the standby gas treatment subsystem capable of being placed in operations.

The proposed Condition D states that when DRAIN TIME is < 8 hours to (1) immediately initiate action to establish an additional method of water injection with water sources capable of maintaining RPV water level > TAF for ≥ 36 hours, and (2) immediately initiate action to establish secondary containment boundary, and (3) immediately initiate action to isolate each secondary containment penetration flow path or verify it can be manually isolated from the control room, and (4) immediately initiate action to verify one standby gas treatment subsystem is capable of being placed in operation. Additionally, there is a note stating that required ECCS injection/spray subsystem or additional method of water injection shall be capable of operating without offsite electrical power, which is similar to proposed Condition B. The current QCNPS TS for Condition D (Required Action C.2 and associated Completion Time not met) is similar to proposed Condition D. The proposed Condition D provides adequate protection should the DRAIN TIME be < 8 hours because associated Required Actions D.1, D.2, D.3, and D.4 require that the licensee establish an additional method of water injection (without offsite electrical power), establish secondary containment, isolate additional flow paths, and have the standby gas treatment subsystem capable of being placed in operation.

The proposed Condition E states that when the required action and associated completion time of Condition C or D is not met, or the DRAIN TIME is < 1 hour, then immediately initiate action to restore DRAIN TIME to ≥ 36 hours. The proposed Condition E is new, as it is not present in the current QCNPS TS. The proposed Condition E is acceptable because it provides the necessary step to restore the DRAIN TIME to ≥ 36 hours should the other conditions not be met, or if the DRAIN TIME is < 1 hour.

The NRC staff reviewed the proposed changes to TS 3.5.2 and finds them acceptable based on the actions taken to mitigate the water level reaching the TAF with the water sources available

and maintaining DRAIN TIME ≥ 36 hours. The LCO correctly specifies the lowest functional capability or performance levels of equipment required for safe operation of the facility in accordance with 10 CFR 50.36(c)(2)(i). The proposed TS provides reasonable assurance that the Required Actions to be taken when the LCO is not met can be conducted without endangering the health and safety of the public in accordance with 10 CFR 50.57(a)(3)(i).

3.3.1 Staff Evaluation of Proposed TS 3.5.2 SRs

The proposed TS 3.5.2 SRs include verification of DRAIN TIME, verification of water levels/volumes that support ECCS injection/spray subsystems, verification of water filled pipes to preclude water hammer events, verification of correct valve positions for the required ECCS injection/spray subsystem, operation of the ECCS injection/spray systems through the recirculation line, verification of valves credited for automatic isolation actuated to the isolation position, and verification that the required ECCS injection/spray subsystem can be manually operated. Each of the seven SRs are described below.

SR 3.5.2.1: The DRAIN TIME would be determined or calculated, and required to be verified to be ≥ 36 hours in accordance with the SFCP. This surveillance would verify that the LCO for DRAIN TIME is met. Numerous indications of changes in RPV level are available to the operator. The NRC staff considers the period of 36 hours to be reasonable to identify and initiate action to mitigate draining of reactor coolant (normally 3 operator shifts). Changes in RPV level would necessitate recalculation of the DRAIN TIME.

SR 3.5.2.2 (previously SR 3.5.2.1): The suppression pool water level (≥ 8.5 ft) or contaminated condensate storage tank level (≥ 140,000 available gallons) for the required ECCS injection/spray subsystem is required to be verified to ensure pump net positive suction head and vortex prevention. Indications are available either locally or in the control room regarding suppression pool water level. This surveillance would be required to be performed in accordance with the SFCP.

SR 3.5.2.3 (previously SR 3.5.2.2): The SR to verify the ECCS injection/spray subsystem piping is sufficiently filled of water would be retained from the existing TS 3.5.2. The proposed change would update the SR to reflect the proposed change to LCO 3.5.2, which would require, in part, one low pressure ECCS injection/spray subsystem to be operable instead of two. The SR 3.5.2.3 wording would change from "Verify, for each required ECCS . . ." to "Verify, for the required ECCS . . ." This change clarifies the requirement to maintain consistency with the proposed LCO.

Maintaining the pump discharge lines of the required ECCS injection/spray subsystem sufficiently full with water ensures that the ECCS subsystem will perform properly. Acceptance criteria are established for the volume of accumulated gas at susceptible locations. If accumulated gas is discovered that exceeds the acceptance criteria for the susceptible location (or the volume of accumulated gas at one or more susceptible locations exceeds an acceptance criterion for gas volume at the suction or discharge of a pump), the surveillance is not met. If it is determined by subsequent evaluation that the ECCS injection/spray subsystem is not rendered inoperable by the accumulated gas (i.e., the system is sufficiently filled with water), the surveillance may be declared met. Monitoring may not be practical for locations that are inaccessible due to radiological or environmental conditions, the plant configuration, or personnel safety. For these locations, alternative methods (e.g., operating parameters, remote monitoring) may be used to monitor the susceptible location. Monitoring is not required for susceptible locations where the maximum potential accumulated gas void volume has been

evaluated and determined to not challenge system operability. The accuracy of the method used for monitoring the susceptible locations and trending of the results should be sufficient to assure system operability during the surveillance interval. This surveillance would be required to be performed in accordance with the SFCP.

SR 3.5.2.4 (previously SR 3.5.2.3): The SR to verify the correct alignment for manual, power operated, and automatic valves in the required ECCS subsystem flow path would be retained from the existing TS 3.5.2. Similar to the change discussed above for proposed SR 3.5.2.3, changes to SR 3.5.2.4 would clarify a proposed requirement for LCO 3.5.2. The proposed SR wording, "Verify, for the required ECCS injection/spray subsystem, each manual . . ." would replace "Verify each required ECCS injection/spray subsystem manual . . ." The SR 3.5.2 would provide assurance that the proper flow path will be available for ECCS operation to support TS 3.5.2. This surveillance would be required to be performed in accordance with the SFCP. This SR would not apply to valves that are locked, sealed, or otherwise secured in position, since these valves would be verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an initiation signal is allowed to be in a nonaccident position provided the valve will automatically reposition in the proper stroke time. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a note stating that it is not required to be met for system vent flowpaths opened under administrative control. This note would require, under administrative control, a dedicated individual to rapidly close the system vent flow path, if directed. The existing Note for SR 3.5.2.3 related to LPCI alignment for decay heat removal would be deleted and a similar note added to the beginning of proposed LCO 3.5.2. This was previously described in SE Section 2.2.5.7 and is further evaluated in Section 3.5.7 (Variation 7).

SR 3.5.2.5: The required ECCS injection/spray subsystem would be required to be operated through its recirculation line for ≥ 10 minutes in accordance with the SFCP. This would demonstrate that the subsystem is capable for operation to support TS 3.5.2, "RPV Water Inventory Control." The STS Bases state that testing the ECCS injection/spray subsystem through the recirculation line is necessary to avoid overfilling the refueling cavity. The minimum operating time of 10 minutes is based on the licensee's engineering judgement.

SR 3.5.2.6: Verifying that each valve credited for automatically isolating a penetration flow path actuates to the isolation position on an actual or simulated RPV water level isolation signal is required to prevent RPV water inventory from dropping below the TAF should an unexpected draining event occur. The frequency is based on the need to perform this surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the surveillance when performed at the selected frequency. Therefore, the licensee concluded that the frequency was acceptable from a reliability standpoint. This surveillance would be required to be performed in accordance with the SFCP.

SR 3.5.2.7 (previously SR 3.5.2.5): This SR would state that the required ECCS injection/spray subsystem can be manually operated. This surveillance requires that the licensee verify that the required CS or LPCI subsystem (including the associated pump and valve(s)) is capable of being manually operated from the control room, and without delay, to provide additional RPV water inventory, if needed. Vessel injection/spray may be excluded from the SR, per the

existing Note. This surveillance would be required to be performed in accordance with the SFCP.

The NRC staff evaluated each of these proposed SRs associated with the new LCO 3.5.2 and concludes they are appropriate for ensuring the operability of the equipment and instrumentation specified in LCO 3.5.2. The staff concludes that each of the proposed SRs are acceptable since they meet the requirements of 10 CFR 50.36(c)(2)(ii) regarding insights gained via operating experience and 10 CFR 50.36(c)(3) for surveillances by ensuring that the necessary quality of systems and components are maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

3.4 Staff Evaluation of Proposed TS Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation"

The LCO 3.3.5.1 currently states that, "The ECCS instrumentation for each Function in Table 3.3.5.1-1, shall be OPERABLE," and the APPLICABILITY says, According to Table 3.3.5.1-1." Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation," contains requirements for function operability during Modes 4 and 5 when the associated ECCS subsystem(s) are required to be operable.

For the following Functions in Table 3.3.5.1-1, the requirements during Modes 4 and 5 would be either completely deleted or relocated to the proposed Table 3.3.5.2-1. Conforming changes were proposed for the Actions table of LCO 3.3.5.1 as well.

FUNCTION	MODE 4/5 APPLICABILITY DELETED	FUNCTION RELOCATED TO TABLE 3.3.5.2-1
1. Core Spray System		
a. Reactor Vessel Water Level - Low Low	Yes	
c. Reactor Steam Dome Pressure - Low (Permissive)	No	Function 1.a
d. Core Spray Pump Discharge Flow - Low (Bypass)	No	Function 1.b
e. Core Spray Pump Start - Time Delay Relay	Yes	
2. Low Pressure Coolant Injection (LPCI) System		
a. Reactor Vessel Water Level - Low Low	Yes	
c. Reactor Steam Dome Pressure - Low (Permissive)	No	Function 2.a
e. Low Pressure Coolant Injection Pump Start - Time Delay Relay Pumps B & D	Yes	
f. Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)	No	Function 2.b

In TS Table 3.3.5.1-1, Footnote (a), which states, "When associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS – Shutdown," will be deleted. Footnote (b) will be designated as Footnote (a).

In TS Table 3.3.5.1-1, Functions 1.a, 1.e, 2.a, and 2.e, the Modes 4 and 5 requirements would be deleted. The QCNPS TSs currently require automatic initiation of ECCS pumps on low reactor vessel water level. However, in Modes 4 and 5, automatic initiation of ECCS pumps

could result in overfilling the refueling cavity or water flowing into the main steam lines, potentially damaging plant equipment.

The NRC staff finds the deletion of Modes 4 and 5 requirements for the listed functions and the deletion of Footnote (a) acceptable because manual ECCS initiation is preferred over automatic initiation during Modes 4 and 5.

The deletion of Function 1.e and 2.e for the CS pump and LPCI B and D pumps start time delay logic is evaluated in Section 3.5.2 of this SE (Variation 2).

The other four Functions, 1.c, 1.d, 2.c, and 2.f, would be moved to the proposed TS Table 3.3.5.2-1, as discussed in Section 3.2.4.1 of this SE.

3.5 Staff Evaluation of Proposed Technical Variations

The licensee proposed the following technical variations from the TS changes described in TSTF-542 or the applicable parts of the associated NRC staff's SE. The licensee stated in the LAR that these variations do not affect the applicability of TSTF-542 or the NRC staff's SE to the proposed license amendment. The NRC staff evaluated each variation as discussed below.

3.5.1 Variation 1, TS Table 3.3.5.2-1, Footnote (a) Missing from Two Functions

In accordance with TSTF-542, Revision 2, TS Table 3.3.5.2-1, Function 1.a (Core Spray System Reactor Steam Dome Pressure - Low (Injection Permissive)), and Function 2.a (Low Pressure Coolant Injection (LPCI) Reactor Steam Dome Pressure - Low (Injection Permissive)) are required in Modes 4 and 5. Prior to TSTF-542, the analogous Functions 1.c and 2.c in TS Table 3.3.5.1-1 had a Modes 4 and 5 applicability modified by a footnote specifying that these functions were only required when the associated ECCS subsystem(s) were required to be operable per LCO 3.5.2, "ECCS Shutdown."

A variation is proposed to affix Footnote (a) (i.e., "Associated with an ECCS subsystem required to be OPERABLE by LCO 3.5.2, 'Reactor Pressure Vessel Water Inventory Control'") to the "Required Channels Per Function" column of Functions 1.a and 2.a of TS Table 3.3.5.2-1.

The NRC staff concludes that the footnote was inadvertently omitted from Table 3.3.5.2-1 Functions 1.a and 2.a in TSTF-542. Without the footnote, the Reactor Steam Dome Pressure – Low functions would be required to be operable for all low pressure ECCS subsystems, regardless of whether they are credited for meeting LCO 3.5.2. Requiring the functions for all ECCS subsystems is unnecessary. In Modes 4 and 5 with the reactor steam dome at atmospheric pressure, these functions only serve to satisfy permissives for opening low pressure ECCS injection valves for manual actuation. Therefore, the NRC staff finds that Variation 1 is acceptable.

3.5.2 Variation 2, TS Table 3.3.5.1-1, Time Delays for CS and LPCI

There are QCNPS specific instrumentation functions that differ from the STS. Current TS Table 3.3.5.1-1, Functions 1.e and 2.e describe pump start time delay relays for the CS and LPCI pumps. The licensee stated that these functions can be removed from the TS during Modes 4 and 5 because the required ECCS subsystem is proposed to be started by manual operation.

The NRC finds that the ECCS injection/spray pump start time delay relay logic is unnecessary given the new requirements set forth in TSTF-542, DRAIN TIME and WIC. The purpose of the time delay relays is to stagger the start of the ECCS injection/spray pumps, thus limiting the starting transients on the 4.16 kilovolt essential buses. This time delay is unnecessary for manual operation, thus this function can be removed from the TS. Therefore, the NRC staff finds that Variation 2 is acceptable.

3.5.3 Variation 3, TS Table 3.3.5.2-1 Channel Checks

The licensee stated that QCNPS does not currently have the capability to perform Channel Checks for proposed TS Table 3.3.5.2-1 Functions 1.a, "Reactor Steam Dome Pressure - Low (Permissive)," 1.b, "Core Spray Pump Discharge Flow - Low (Bypass)," 2.a, "Reactor Steam Dome Pressure - Low (Permissive)," and 2.b, "Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)." The current QCNPS TSs do not include Channel Checks for these functions; therefore, no Channel Check SR was added for these functions.

The NRC staff confirmed that the above instrument Functions do not have existing Channel Check requirements in existing TS Table 3.3.5.1-1, and that no future Channel Checks were proposed for the instruments being relocated to new TS Table 3.3.5.2-1. Because the licensee does not currently perform Channel Checks for the above instruments and proposes to retain its current licensing basis for these instruments (i.e., no Channel Check), the NRC staff finds that Variation 3 is acceptable.

3.5.4 Variation 4, LPCI Channel per Loop versus Channel per Pump

The QCNPS units each have two LPCI loops with two pumps in each loop (i.e., four LPCI pumps per unit). The QCNPS TSs currently require one operable channel for each LPCI loop for the "Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)" Function. The licensee proposed to maintain the one channel per loop for TS 3.3.5.2, Function 2.b, in lieu of one channel per pump as described in the STS, because at QCNPS, there is only one flow transmitter for each loop that monitors the flow of both pumps in that loop (i.e., two LPCI loop flow transmitters per unit).

The NRC staff reviewed this variation and determined that the slight design differences between QCNPS (loop) and STS (pump) will not affect the associated DRAIN TIME and automatic actions to the LPCI pump protection for overheating during low flow conditions. Also, the licensee has chosen to retain the current licensing basis for these instruments. Therefore, the NRC staff finds that Variation 4 is acceptable.

3.5.5 Variation 5, CS and LPCI Manual Initiation Logic

The licensee stated that the current QCNPS TSs do not include a manual initiation logic function for the CS or LPCI subsystems. Therefore, because this function does not exist at QCNPS, manual initiation functions for CS and LPCI are not being included in TS Table 3.3.5.2-1. Additionally, because the manual initiation functions are not included in Table 3.3.5.2-1, the associated Logic System Functional Test would likewise not be required for TS 3.3.5.2; therefore, TS 3.3.5.2 as proposed does not include a Logic System Functional Test SR. The licensee proposed that TS 3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control," include an SR to verify that the CS and LPCI subsystems can be manually operated.

The licensee further stated the following justification for the variation. The manual operation of the CS and LPCI subsystems for the control of reactor cavity or RPV inventory are relatively simple evolutions and involve the manipulation of a small number of components. These subsystem alignments can be performed by licensed operators from the Main Control Room. This alternative is justified because a draining event is a slow evolution when compared to a design basis LOCA, which is assumed to occur at full power, and thus, there is adequate time to take manual actions (i.e., hours versus minutes). Adequate time to take action is assured since the proposed TS 3.5.2 Condition E prohibits plant conditions that result in drain times that are less than one hour. Therefore, there is sufficient time for the licensed operators to take manual action to stop an unanticipated draining event, and to manually start an ECCS injection/spray subsystem or the additional method of water injection. Consequently, there is no need for manual initiation logic to actuate the required subsystem components. Because the CS and LPCI subsystems can be placed in service using manual means in a short period of time (i.e., within the timeframes assumed in the development of TSTF-542) by using controls and indications that are readily available in the Main Control Room (MCR), manual operation of the required subsystem would be an equivalent alternative to system initiation via manual initiation logic.

The NRC staff reviewed the licensee's proposed change and verified that the current TSs do not include manual initiation logic functions for the CS and LPCI subsystems. The staff determined that, although QCNPS does not have the capability to start an ECCS subsystem with a single push button, the components that provide ECCS injection/spray into the RPV can be started from the MCR, as required, to support Modes 4 and 5 operations. The manipulation of low pressure ECCS subsystem components from the MCR would be verified in accordance with new SR 3.5.2.7. This surveillance requires that the licensee verify that the required CS or LPCI subsystem (including associated pump switches, and valve(s)) can be manually operated to provide additional RPV water inventory, if needed. Therefore, the NRC staff finds that Variation 5 is acceptable.

3.5.6 Variation 6, RWCU and RHR SDC Channel Inputs

The licensee stated that automatic isolation on Reactor Vessel Water Level - Low Functions for the RWCU and RHR SDC systems at QCNPS varies slightly from the system described in the STS. These functions receive input from four reactor vessel water level channels. Each channel inputs into one of four trip strings, and two trip strings make up a trip system. The trip systems are aligned in a parallel configuration, so both trip systems must trip in order to cause an isolation of the RWCU or RHR SDC system valves. Any channel will trip its associated trip string and trip system. Therefore, both trip systems with one trip string in each trip system is required to provide for automatic RWCU and RHR SDC system isolation. Proposed TS Table 3.3.5.2-1 would reflect the QCNPS requirement for one operable channel in each Reactor Vessel Water Level - Low isolation trip system for RWCU and RHR SDC.

The NRC staff reviewed the differences between the QCNPS and STS requirements for RWCU and RHR SDC system trip systems and determined that any single channel will trip its associated trip string and trip system and will not affect the ability of QCNPS to initiate system isolation when needed to support DRAIN TIME. Therefore, the NRC staff finds that Variation 6 is acceptable.

3.5.7 Variation 7, TS LCO 3.5.2 Note

The licensee explained that, unlike the STS, the QCNPS TSs do not currently contain a Note applicable to LCO 3.5.2 that allows an LPCI subsystem to be considered operable when aligned for decay heat removal. Instead, this Note is currently associated with existing SR 3.5.2.3 (i.e., proposed SR 3.5.2.4). The proposed LCO 3.5.2 includes this Note to align with the STS. The licensee considers this a minor variation, as the purpose of the Note is the same as the one described in the STS and the Note is applicable to QCNPS.

The NRC staff finds that the added footnote to LCO 3.5.2 associated with the LPCI subsystem is appropriate and is consistent with TSTF-542 which places this note within the LCO. Without the note, the associated RHR pump would be declared inoperable, which would be contrary to the intent of the existing note for SR 3.5.2.3 which allows the LPCI subsystem to be operable when aligned for decay heat removal. Therefore, the NRC staff finds Variation 7 acceptable.

3.5.8 Variation 8, Suppression Pool and Contaminated Condensate Storage Tank

The licensee stated that, at QCNPS, verification of suppression pool level and contaminated condensate storage tank volume is contained in a single SR (i.e., existing SR 3.5.2.1 and proposed SR 3.5.2.2) versus in separate SRs as found in the STS. This does not affect the applicability of TSTF-542.

The NRC staff notes that the current QCNPS SR 3.5.2.1 (proposed SR 3.5.2.2) requires that both the suppression pool water level and the contaminated condensate storage tank(s) water volume be verified for each ECCS injection/spray subsystem (i.e., CS and LPCI). The STS SR 3.5.2.1 requires that the suppression pool water level be verified for each required LPCI subsystem, and STS SR 3.5.2.2 requires that both the suppression pool water level and the contaminated condensate storage tank(s) water volume be verified for each required core spray subsystem. The existing QCNPS TSs do not have a separate SR for LPCI and CS, but instead combines these two surveillances into one SR. To remain consistent with its current TS SR, the licensee is proposing to retain the SR as one surveillance for both subsystems. The NRC staff has reviewed the variation and finds it acceptable because the required STS SRs 3.5.2.1 and 3.5.2.2 (redesignated as 3.5.2.2 and 3.5.2.3 in TSTF-542, Revision 2) is accomplished by the single QCNPS SR 3.5.2.1 (proposed SR 3.5.2.2).

3.5.9 Variation 9, TS 3.6.1.3, Condition F

The licensee proposed to delete TS 3.6.1.3, "Primary Containment Isolation Valves (PCIVs)," Condition F and all of its associated Required Actions. The Applicability of TS 3.6.1.3 is Modes 1, 2, and 3, and "When associated instrumentation is required to be OPERABLE per LCO 3.3.6.1, 'Primary Containment Isolation Instrumentation.'" The licensee stated that this change is justified because OPDRV requirements would be deleted, and Mode 4 and 5 PCIV requirements would be relocated from TS 3.3.6.1 and 3.6.1.3 to the proposed TS 3.3.5.2. Thus, there are no longer any PCIVs required to be operable by TS 3.6.1.3 during Mode 4 or 5. The licensee further stated that these requirements are addressed by the proposed TS 3.3.5.2 in their entirety, and that following the removal of OPDRV and relocation of Mode 4 and 5 requirements, Condition F and associated Actions in TS 3.6.1.3 would never be applicable; therefore, are no longer necessary.

The NRC staff evaluated the licensee's proposed variation. QCNPS TS 3.6.1.3, Condition F, states, "Required Action and associated Completion Time of Condition A, B, C, or D not met for

PCIV(s) required to be Operable during Modes 4 or 5." (TS 3.6.1.3, Condition E, is similar to Condition F, but applies to Modes 1, 2, or 3.) The licensee has proposed to relocate the requirements pertaining to PCIVs for Modes 4 and 5 from TSs 3.3.6.1 and 3.6.1.3 to proposed TS 3.3.5.2. The staff finds that because the RPV WIC requirements would be consolidated into TSs 3.3.5.2 and 3.5.2, the Modes 4 and 5 requirements in TS 3.6.1.3 would no longer be applicable. The NRC staff concludes that the proposed variation is acceptable because the requirements for PCIVs for Modes 4 and 5 will be preserved, but only relocated to a new TS table.

3.5.10 Variation 10, Deletion of Note 2 in SR 3.8.2.1

In the September 27, 2018, supplement, the licensee proposed to modify SR 3.8.2.1. Specifically, the licensee proposed to delete Note 2 from SR 3.8.2.1. Note 2 states:

> SR 3.8.1.13 and SR 3.8.1.19 are not required to be met when associated ECCS subsystem(s) are not required to be OPERABLE per LCO 3.5.2, "ECCS-Shutdown."

Currently, SR 3.8.2.1 requires that all of the SRs of TS 3.8.1 be met, with some listed exceptions. The licensee also proposed to add SRs 3.8.1.13 and 3.8.1.19 to this list (described in Section 2.2.5.10 of this SE.)

The NRC staff finds that the proposed changes to SR 3.8.2.1 would eliminate the requirement to perform SRs 3.8.1.13 and 3.8.1.19 while LCO 3.8.2 is applicable, which is during Modes 4 and 5, and during the movement of irradiated fuel.

LCO 3.8.2 requires that one diesel generator capable of supplying one division of onsite Class 1E alternating current (AC) electrical power distribution subsystem(s) be operable. SR 3.8.2.1 requires that for the AC sources required to be operable (e.g., one diesel generator as required in LCO 3.8.2), the SRs of TS 3.8.1 are applicable with three exceptions. Per SRs 3.8.1.13 and 3.8.1.19, each DG is required to automatically start on an ECCS signal and on an ECCS signal concurrent with a loss of offsite power signal, respectively.

The NRC staff reviewed the proposed change and concludes that SRs 3.8.1.13 and 3.8.1.19 test automatic functions that are not necessary for water inventory control per TSTF-542. Section 2.5.2 of TSTF-542, Revision 2 (ADAMS Accession No. ML16074A448) states, in part:

> Automatic initiation of ECCS pumps could result in overfilling the refueling cavity or water flowing into the main steam lines, potentially damaging plant equipment. This requires operators to move their immediate attention during a draining event from stopping the event to stopping the ECCS pumps. The proposed change requires an ECCS subsystem to be operable and capable of manual initiation, but allows the operator to use other, more appropriately sized pumps if needed to mitigate a draining event.

Based on the above, the NRC staff finds that this proposed change is in alignment with the intent of TSTF-542, which includes requiring that the licensee be able to mitigate a drain down event using a manually-controlled ECCS subsystem. Since automatic actuation of ECCS is not required to perform manual operation during Modes 4 and 5, the NRC staff finds that Variation 10 is acceptable.

3.6 Staff Evaluation of Proposed Deletion of References to OPDRVs Term and Corresponding Changes

Section 2.2.4 above lists the numerous OPDRVs references proposed for deletion. The proposed changes would replace the existing specifications related to OPDRVs with revised specifications for RPV WIC.

The term OPDRVs is not defined in the current TSs and historically has been subject to inconsistent application by licensees. The changes proposed by the licensee are intended to resolve any ambiguity by creating a new RPV WIC TS with attendant equipment operability requirements, required actions and SRs, and deleting references to OPDRVs throughout the TS.

The current QCNPS TSs contain instrumentation requirements related to OPDRVs in four TSs and three of these have the OPDRVs phrases described in Section 2.2.4.1 of this SE, and in TS 3.3.5.1. The proposed TS 3.3.5.2 consolidates the instrumentation requirements into a single location to simplify the presentation and provide requirements consistent with TS 3.5.2. The remaining TSs with OPDRVs requirements are for primary and secondary containment, primary and secondary containment isolation valves, standby gas treatment system, CREV system, control room emergency ventilation air conditioning system, and electrical sources. The licensee proposed to consolidate each of these systems' requirements during OPDRVs into revised TS 3.5.2 for RPV WIC, based on the appropriate plant conditions and calculated DRAIN TIME.

The proposed deletion of SR 3.8.2.1, Note 2 was previously described and evaluated in Section 3.5.10 of this SE.

The NRC staff concludes that the deletion of OPDRV references, along with the conforming editorial changes listed in Section 2.2.4.1 of this SE, are appropriate because the proposed TSs governing RPV WIC and the associated instrumentation, TSs 3.5.2 and 3.3.5.2, respectively, are clarified and simplified as an alternative set of controls for ensuring water level is maintained above Safety Limit 2.1.1.3. Therefore, the staff finds that these changes are acceptable.

3.7 TS 3.10, "Special Operations," and TSTF-484

The current LCO associated with QCNPS TS 3.10.8, "Inservice Leak and Hydrostatic Testing Operations," allows performance of an inservice leak or hydrostatic test with the average reactor coolant temperature greater than 212 °F, while considering operational conditions to still be in Mode 4, provided certain secondary containment LCOs are met.

The TSTF-484, "Use of TS 3.10.1 for Scram Time Testing Activities," Revision 0 (ADAMS Accession No. ML052930102), revised LCO 3.10.1 to expand its scope to include operations where the temperature exceeds 200 °F: (1) as a consequence of maintaining adequate reactor pressure for an inservice leak or hydrostatic test, or (2) as a consequence of maintaining adequate reactor pressure for control rod scram time testing initiated in conjunction with an inservice leak or hydrostatic test.

By Amendment Nos. 261 and 256 (QCNPS Units 1 and 2, respectively), dated December 17, 2015, the NRC approved changes to QCNPS TS LCO 3.10.8 in accordance with TSTF-484 (ADAMS Accession No. ML15324A439). The NRC staff's SE for these amendments stated, in part, that, "two low pressure ECCS injected/spray (i.e., CS or LPCI) subsystems are required to

be operable in Mode 4 at DNPS [Dresden Nuclear Power Station] and QCNPS per TS 3.5.2, ECCS-Shutdown."

However, per the proposed new LCO 3.5.2, only one low pressure ECCS subsystem would be required to be operable in Mode 4.

The NRC staff concludes that changing from two ECCS injection/spray subsystems to one ECCS injection/spray subsystem is acceptable because, as stated previously in Section 3.3 of this SE, this level of redundancy is not required, even during application of LCO 3.10.8. When the licensee applies LCO 3.10.8 at the end of a refueling outage, an exceptionally large volume of water is present in the reactor vessel since the vessel is nearly water solid. There is much more water in the reactor vessel than is present during power operation. Small leaks from the reactor coolant system would be detected by inspections before a significant loss of inventory occurred. In the event of a large reactor coolant system leak, the RPV would rapidly depressurize and allow operation of the low pressure ECCS. At low decay heat values, and near Mode 4 conditions, the stored energy in the reactor core will be very low. Therefore, the licensee's reasoning that operators would have time to respond with manual actions to start any ECCS pumps and properly align valves for injection from the control room remains valid.

As stated previously in Section 3.3 of this SE, with one ECCS injection/spray subsystem and non-safety related injection sources, defense-in-depth will be maintained. The defense-in-depth measure is consistent with other events considered during shutdown with no additional single failure assumed. The DRAIN TIME controls, in addition to the required ECCS injection/spray subsystem, provide reasonable assurance that an unexpected draining event can be prevented or mitigated before the RPV water level would be lowered to the Safety Limit of TS 2.1.1.3.

Based on the evaluation in Sections 3.2 and 3.3 of this SE, including a review of the SE for Amendment Nos. 261 and 265 (ADAMS Accession No. ML15324A439) above, the NRC staff determined that proposed LCO 3.3.5.2 and LCO 3.5.2 continue to represent either the lowest functional capability or performance level of equipment required for safe operation of the facility. Therefore, the staff finds that the licensee's proposed changes to TS 3.3.5.2 and TS 3.5.2 are acceptable.

3.8 Technical Conclusion

The QCNPS Safety Limit 2.1.1.3 requires that "reactor vessel water level shall be greater than the top of active irradiated fuel." As noted in SE Section 2.1, maintaining water level above the TAF ensures that the fuel cladding fission product barrier is protected during shutdown conditions. The proposed TS changes evaluated within this SE establish new TS requirements that address the preventive and mitigative equipment and associated instrumentation that provide an alternative means to support Safety Limit 2.1.1.3 during Modes 4 and 5 operations.

During Modes 4 and 5 conditions, the reactor coolant system is at a low operating temperature (< 212 °F) and is depressurized. An event involving a loss of inventory while in the shutdown condition does not exceed the capacity of one ECCS subsystem. The accidents that are postulated to occur during shutdown conditions, the design basis fuel handling accidents inside containment and spent fuel storage building (UFSAR, Section 15.7.2), and the postulated liquid release due to liquid tank failure (UFSAR 15.7.1), do not involve a loss of inventory. Therefore, the equipment and instrumentation associated with the RPV WIC TS do not provide detection or mitigation related to these design basis accidents.

The proposed TS LCO 3.5.2 contains a requirement for operability of one ECCS subsystem along with a requirement to maintain a sufficiently long DRAIN TIME so that plant operators would have time to diagnose and mitigate an unplanned draining event. The NRC staff concludes that LCO 3.5.2 and LCO 3.3.5.2 provide for the lowest functional capability or performance levels of equipment required for safe operation of the facility and, therefore, meet the requirements of 10 CFR 50.36(c)(2)(i).

Additionally, the revised TSs 3.5.2 and 3.3.5.2 provide remedial actions to be taken in the event the LCO is not satisfied and, therefore, meet the requirements of 10 CFR 50.36(c)(2)(i).

The NRC staff finds that the proposed Action statements provide reasonable assurance that an unexpected draining event can be prevented or mitigated before the RPV water level would be lowered to the TAF.

The NRC staff evaluated the proposed DRAIN TIME definition, TS 3.5.2, which contains the requirements for RPV WIC, and TS 3.3.5.2, which contains the requirements for instrumentation necessary to support TS 3.5.2. Based on the considerations discussed above, the NRC staff concludes that the proposed revisions are acceptable because they consolidate and clarify the RPV WIC requirements, which meet 10 CFR 50.36(c)(2)(ii)(D), Criterion 4, to establish LCOs for structures, systems, or components significant to public health and safety as evidenced by operating experience.

The licensee proposed to delete OPDRV references from the TS Applicability descriptions, Conditions, Required Actions, and Footnotes. The NRC staff reviewed the proposed changes and determined that the deletion of OPDRVs references, along with the corresponding editorial changes, are appropriate because the proposed TSs governing RPV WIC and the associated instrumentation, TSs 3.5.2 and 3.3.5.2, respectively, are a clarified and simplified alternative set of controls for ensuring that water level is maintained above the TAF.

The NRC staff reviewed the SRs associated with the new LCOs 3.5.2 and 3.3.5.2. The NRC staff finds that the proposed TS SRs in TS 3.5.2 are acceptable because they support TS 3.5.2 DRAIN TIME requirements, assure that water inventory is available for ECCS injection/spray subsystem RPV injection and pump performance, ECCS injection/spray subsystems are adequately filled (mitigates effects of gas accumulation or voiding), the subsystems have verified valve positions to support RPV injection, verify pumps provide adequate flow to support DRAIN TIME and RPV injection, verify automatic isolation, and that ECCS injection/spray subsystems can be manually operated. The NRC staff finds that the two SRs proposed for TS 3.3.5.2 are adequate because they ensure that the Functions are capable of performing their specified safety functions in support of TS 3.5.2, DRAIN TIME, and the protection from a potential drain down of the RPV in Modes 4 and 5. Therefore, the NRC staff concludes that the proposed SRs satisfy 10 CFR 50.36(c)(3).

The NRC staff evaluated the proposed QCNPS changes against each of the unit's applicable design requirements listed in Section 2.3.1 of this SE. The NRC staff finds that the proposed changes for Modes 4 and 5 operations, as they relate to the proposed TS changes for the new DRAIN TIME definition and the removal of OPDRV references, remain consistent with the QCNPS design criteria in that the QCNPS design requirements for instrumentation, reactor coolant leakage detection, the reactor coolant pressure boundary, and reactor coolant makeup are unaffected.

The regulation at 10 CFR 50.36(a)(1) states that a summary statement of the bases or reasons for such specifications, other than those covering administrative controls, shall also be included in the application, but shall not become part of the TSs. In accordance with this requirement, the licensee provided TS Bases changes in the proposed LAR. The NRC staff notes that the TS Bases changes provided describe the basis for the affected TS and follow the Final Policy Statement on TSs Improvements for Nuclear Power Reactors (58 FR 39132, dated July 22, 1993).

Additionally, the proposed TS changes were reviewed for technical clarity and consistency with the existing QCNPS requirements for customary terminology and formatting. The NRC staff found that the proposed changes are consistent with TSTF-542, Revision 2, and SRP Chapter 16.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment on November 8, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change the requirements with respect to installation or use of a facility's components located within the restricted area as defined in 10 CFR Part 20 and change SRs. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration (83 FR 17861), and there has been no public comment on such finding. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by 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.

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- The number of required channels is changed from [2], with a column header that states "Required Channels per Trip System," to [2 in one trip system]. This retains the requirement that the two channels must be associated with the same trip system. Only one trip system is required to ensure automatic isolation of one of the two isolation valves will occur on low reactor vessel water level.

- The TS 3.3.6.1 Required Action J.1 and J.2 for an inoperable channel is to immediately initiate action to restore the channel to operable status or to immediately initiate action to isolate the RHR Shutdown Cooling system. The TS 3.5.2 Action B requires declaring the associated penetration flow path(s) incapable of automatic isolation. This will require Drain Time to be recalculated without crediting automatic isolation of the affected penetration flow paths and following any applicable Actions. The proposed Actions are consistent with the definition of Drain Time and the requirements of LCO 3.5.2.

- A Channel Check and Channel Functional Test are required at the existing Frequency. A calibration of the trip unit, Channel Calibration, and Logic System Functional Test are no longer required in Modes 4 and 5, as discussed in Section 3.3.3.

- The allowable value is unchanged.

3.3.4.5. 4.a, BWR/4 Reactor Water Cleanup (RWCU) System Isolation, Reactor Vessel Water Level - Low Low, Level 2

The definition of DRAIN TIME allows crediting the closing of penetration flow paths that are capable of being automatically isolated by RPV water level isolation instrumentation prior to the RPV water level being equal to the TAF. The Reactor Vessel Water Level - Low Low, Level 2 Function associated with RWCU System isolation may be credited for automatic isolation of penetration flow paths associated with the RWCU System.

Reactor Vessel Water Level - Low Low, Level 2 is initiated from two channels per trip system that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. Each trip system isolates one of two redundant isolation valves and only one trip system is required to be operable when automatic isolation of the associated penetration flow path(s) is credited in calculating Drain Time to meet LCO 3.5.2.

The Reactor Vessel Water Level - Low Low, Level 2 Allowable Value was chosen to be the same as the ECCS Reactor Vessel Water Level - Low Low, Level 2 Allowable Value (LCO 3.3.5.1), since the capability to cool the fuel may be threatened.

The Reactor Vessel Water Level - Low Low, Level 2 Function is only required to be OPERABLE when automatic isolation of the associated penetration flow path is credited in calculating DRAIN TIME.

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – ISSUANCE OF AMENDMENT NOS. 273 AND 268 REGARDING ADOPTION OF TSTF-542, "REACTOR PRESSURE VESSEL WATER INVENTORY CONTROL" (EPID L-2018-LLA-0049) DATED JANUARY 28, 2019

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