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

October 30, 2018

Mr. Bradley J. Sawatzke
Chief Executive Officer
Energy Northwest
76 North Power Plant Loop
P.O. Box 968 (Mail Drop 1023)
Richland, WA 99352-0968

SUBJECT: COLUMBIA GENERATING STATION - ISSUANCE OF AMENDMENT RE: REVISION TO TECHNICAL SPECIFICATIONS TO ADOPT TSTF-542, REVISION 2, "REACTOR PRESSURE VESSEL WATER INVENTORY CONTROL" (EPID L-2017-LLA-0361)

Dear Mr. Sawatzke:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 251 to Renewed Facility Operating License No. NPF-21 for the Columbia Generating Station (Columbia). The amendment consists of changes to the technical specifications (TS) in response to your application dated October 23, 2017, as supplemented by letters dated November 15, 2017, and June 27, 2018.

The amendment revises the existing Columbia TS requirements related to "operations with a potential for draining the reactor vessel," with revised TSs providing an alternative for reactor pressure vessel (RPV) water inventory control. These alternative requirements would protect the Columbia TS Safety Limit 2.1.1.3, which requires RPV water level to be greater than the top of active irradiated fuel.

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

Sincerely,

L. John Klos, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosures:
1. Amendment No. 251 to NPF-21
2. Safety Evaluation

cc: Listserv

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

ENERGY NORTHWEST

DOCKET NO. 50-397

COLUMBIA GENERATING STATION

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 251
License No. NPF-21

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

   A. The application for amendment by Energy Northwest (the licensee), dated October 23, 2017, as supplemented by letters dated November 15, 2017, and June 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 2.C.(2) of Renewed Facility Operating License No. NPF-21 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 251 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of its date of issuance and shall be implemented at the beginning of the next refueling outage scheduled for May 2019.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert J. Pascarelli, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License No. NPF-21
and Technical Specifications

Date of Issuance: October 30, 2018

ATTACHMENT TO LICENSE AMENDMENT NO. 251

COLUMBIA GENERATING STATION

RENEWED FACILITY OPERATING LICENSE NO. NPF-21

DOCKET NO. 50-397

Replace the following pages of the Renewed Facility Operating License No. NPF-21 and Appendix A, Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Renewed Facility Operating License

REMOVE	INSERT
-4-	-4-

Technical Specifications

REMOVE	INSERT	REMOVE	INSERT
i	i	3.3.6.1-9	3.3.6.1-9
ii	ii	3.3.6.2-4	3.3.6.2-4
1.1-2	1.1-2	3.3.7.1-4	3.3.7.1-4
1.1-3	1.1-3	3.5.1-1	3.5.1-1
1.1-4	1.1-4	3.5.2-1	3.5.2-1
1.1-5	1.1-5	3.5.2-2	3.5.2-2
1.1-6	1.1-6	3.5.2-3	3.5.2-3
1.1-7	1.1-7	3.5.2-4	3.5.2-4
---	1.1-8	---	3.5.2-5
3.3.5.1-1	3.3.5.1-1	---	3.5.2-6
3.3.5.1-2	3.3.5.1-2	3.5.3-1	3.5.3-1
3.3.5.1-3	3.3.5.1-3	3.6.1.3-1	3.6.1.3-1
3.3.5.1-7	3.3.5.1-7	3.6.1.3-5	3.6.1.3-5
3.3.5.1-8	3.3.5.1-8	3.6.4.1-1	3.6.4.1-1
3.3.5.1-9	3.3.5.1-9	3.6.4.2-1	3.6.4.2-1
3.3.5.1-10	3.3.5.1-10	3.6.4.2-2	3.6.4.2-2
3.3.5.2-1	3.3.5.2-1	3.6.4.3-1	3.6.4.3-1
3.3.5.2-2	3.3.5.2-2	3.6.4.3-2	3.6.4.3-2
3.3.5.2-3	3.3.5.2-3	3.7.3-1	3.7.3-1
3.3.5.2-4	3.3.5.2-4	3.7.3-2	3.7.3-2
---	3.3.5.2-5	3.7.4-1	3.7.4-1
---	3.3.5.3-1	3.7.4-2	3.7.4-2
---	3.3.5.3-2	3.8.2-2	3.8.2-2
---	3.3.5.3-3	3.8.5-2	3.8.5-2
---	3.3.5.3-4	3.8.8-1	3.8.8-1

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 251 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the renewed license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

a. For Surveillance Requirements (SRs) not previously performed by existing SRs or other plant tests, the requirement will be considered met on the implementation date and the next required test will be at the interval specified in the Technical Specifications as revised in Amendment No. 149.

(3) Deleted.

(4) Deleted.

(5) Deleted.

(6) Deleted.

(7) Deleted.

(8) Deleted.

(9) Deleted.

(10) Deleted.

(11) Shield Wall Deferral (Section 12.3.2, SSER #4, License Amendment #7)

The licensee shall complete construction of the deferred shield walls and window as identified in Attachment 3, as amended by this license amendment.

(12) Deleted.

(13) Deleted.

*The parenthetical notation following the title of many license conditions denotes the section of the Safety Evaluation Report and/or its supplements wherein the license condition is discussed.

TABLE OF CONTENTS

1.1 Definitions

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 5.6.3. 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 Total Effective Dose Equivalent (TEDE) 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 those listed in Federal Guidance Report (FGR) 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1988.
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

1.1 Definitions

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 devices 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.

EMERGENCY CORE COOLING SYSTEM (ECCS) RESPONSE TIME

The ECCS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ECCS initiation setpoint at the channel sensor until the ECCS equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays, where applicable. 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.

1.1 Definitions

END OF CYCLE RECIRCULATION PUMP TRIP (EOC-RPT) SYSTEM RESPONSE TIME	The EOC-RPT SYSTEM RESPONSE TIME shall be that time interval from initial signal generation by the associated turbine throttle valve limit switch or from when the turbine governor valve hydraulic control oil pressure drops below the pressure switch setpoint to complete suppression of the electric arc between the fully open contacts of the recirculation pump circuit breaker. 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.
INSERVICE TESTING PROGRAM	The INSERVICE TESTING PROGRAM is the licensee program that fulfills the requirements of 10 CFR 50.55a(f).
ISOLATION SYSTEM RESPONSE TIME	The ISOLATION SYSTEM RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its isolation initiation setpoint at the channel sensor until the isolation 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.
LEAKAGE	LEAKAGE shall be: a. <u>Identified LEAKAGE</u> 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. <u>Unidentified LEAKAGE</u> All LEAKAGE into the drywell that is not identified LEAKAGE; c. <u>Total LEAKAGE</u> Sum of the identified and unidentified LEAKAGE; and d. <u>Pressure Boundary LEAKAGE</u> LEAKAGE through a nonisolable fault in a Reactor Coolant System (RCS) component body, pipe wall, or vessel wall.

1.1 Definitions

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 required logic components (i.e., all required relays and contacts, trip units, solid state logic elements, etc.) 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.
MAXIMUM FRACTION OF LIMITING POWER DENSITY (MFLPD)	The MFLPD shall be the largest value of the fraction of limiting power density (FLPD) in the core. The FLPD shall be the LHGR existing at a given location divided by the specified LHGR limit for that bundle type.
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).
PHYSICS TESTS	PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation. These tests are: a. Described in Chapter 14, Initial Test Program of the FSAR; b. Authorized under the provisions of 10 CFR 50.59; or

1.1 Definitions

PHYSICS TESTS (continued)	
	c. Otherwise approved by the Nuclear Regulatory Commission.
RATED THERMAL POWER (RTP)	RTP shall be a total reactor core heat transfer rate to the reactor coolant of 3544 MWt.
REACTOR PROTECTION SYSTEM (RPS) RESPONSE TIME	The RPS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its RPS trip setpoint at the channel sensor until de-energization of the scram pilot valve solenoids. 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 ≥ 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.
STAGGERED TEST BASIS	A STAGGERED TEST BASIS shall consist of the testing of one of the systems, subsystems, channels, or other designated components during the interval specified by the Surveillance Frequency, so that all systems, subsystems, channels, or other designated components are tested during *n* Surveillance Frequency intervals, where *n* is the total number of systems, subsystems, channels, or other designated components in the associated function.
THERMAL POWER	THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

1.1 Definitions

TURBINE BYPASS SYSTEM RESPONSE TIME	The TURBINE BYPASS SYSTEM RESPONSE TIME shall be the time from when the turbine bypass control unit generates a turbine bypass valve flow signal until 80% of the turbine bypass capacity is established. 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.

Table 1.1-1 (page 1 of 1)
MODES

MODE	TITLE	REACTOR MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE (°F)
1	Power Operation	Run	NA
2	Startup	Refuel[(a)] or Startup/Hot Standby	NA
3	Hot Shutdown[(a)]	Shutdown	> 200
4	Cold Shutdown[(a)]	Shutdown	≤ 200
5	Refueling[(b)]	Shutdown or Refuel	NA

(a) All reactor vessel head closure bolts fully tensioned.

(b) One or more reactor vessel head closure bolts less than fully tensioned.

3.3 INSTRUMENTATION

3.3.5.1 Emergency Core Cooling System (ECCS) Instrumentation

LCO 3.3.5.1 The ECCS instrumentation for each Function in Table 3.3.5.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.5.1-1.

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 3.3.5.1-1 for the channel.	Immediately
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, and 2.b. ---------- 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 feature(s) in both divisions

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. (continued)	B.2	----------NOTE---------- Only applicable for Functions 3.a and 3.b. ---------- Declare High Pressure Core Spray (HPCS) System inoperable. AND	1 hour from discovery of loss of HPCS initiation capability
	B.3	Place channel in trip.	24 hours
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.d, 1.e, 1.f, 2.c, 2.d, 2.e, 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 feature(s) in both divisions
	C.2	Restore channel to OPERABLE status.	24 hours

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. As required by Required Action A.1 and referenced in Table 3.3.5.1-1.	D.1 ----------NOTE---------- Only applicable if HPCS pump suction is not aligned to the suppression pool. ---------- Declare HPCS System inoperable.	1 hour from discovery of loss of HPCS initiation capability
	AND	
	D.2.1 Place channel in trip.	24 hours
	OR	
	D.2.2 Align the HPCS pump suction to the suppression pool.	24 hours
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.g, 1.h, and 2.g. ---------- 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	
	E.2 Restore channel to OPERABLE status.	7 days

Table 3.3.5.1-1 (page 1 of 5)
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. Low Pressure Coolant Injection-A (LPCI) and Low Pressure Core Spray (LPCS) Subsystems					
a. Reactor Vessel Water Level - Low Low Low, Level 1	1, 2, 3	2[b]	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ -142.3 inches
b. Drywell Pressure - High	1, 2, 3	2[b]	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≤ 1.88 psig
c. LPCS Pump Start - LOCA Time Delay Relay	1, 2, 3	1[e]	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 8.53 seconds and ≤ 10.64 seconds
d. LPCI Pump A Start - LOCA Time Delay Relay	1, 2, 3	1[e]	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 17.24 seconds and ≤ 21.53 seconds
e. LPCI Pump A Start - LOCA/LOOP Time Delay Relay	1, 2, 3	1	C	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6	≥ 3.04 seconds and ≤ 6.00 seconds
f. Reactor Vessel Pressure - Low (Injection Permissive)	1, 2, 3	1 per valve	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 448 psig and ≤ 492 psig

(a) Deleted

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

(e) Also supports OPERABILITY of 230 kV offsite power circuit pursuant to LCO 3.8.1 and LCO 3.8.2.

Table 3.3.5.1-1 (page 2 of 5)
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. LPCI and LPCS Subsystems					
g. LPCS Pump Discharge Flow - Low (Minimum Flow)	1, 2, 3	1	E	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 668 gpm and ≤ 1067 gpm
h. LPCI Pump A Discharge Flow - Low (Minimum Flow)	1, 2, 3	1	E	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 605 gpm and ≤ 984 gpm
i. Manual Initiation	1, 2, 3	2	C	SR 3.3.5.1.6	NA
2. LPCI B and LPCI C Subsystems					
a. Reactor Vessel Water Level - Low Low Low, Level 1	1, 2, 3	2[b]	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ -142.3 inches
b. Drywell Pressure - High	1, 2, 3	2[b]	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≤ 1.88 psig
c. LPCI Pump B Start - LOCA Time Delay Relay	1, 2, 3	1[e]	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 17.24 seconds and ≤ 21.53 seconds
d. LPCI Pump C Start - LOCA Time Delay Relay	1, 2, 3	1[e]	C	SR 3.3.5.1.5 SR 3.3.5.1.6	≥ 8.53 seconds and ≤ 10.64 seconds
e. LPCI Pump B Start - LOCA/LOOP Time Delay Relay	1, 2, 3	1	C	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6	≥ 3.04 seconds and ≤ 6.00 seconds

(a) Deleted

(b) Also required to initiate the associated DG.

(e) Also supports OPERABILITY of 230 kV offsite power circuit pursuant to LCO 3.8.1 and LCO 3.8.2.

Table 3.3.5.1-1 (page 3 of 5)
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 B and LPCI C Subsystems					
f. Reactor Vessel Pressure - Low (Injection Permissive)	1, 2, 3,	1 per valve	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 448 psig and ≤ 492 psig
g. LPCI Pumps B & C Discharge Flow - Low (Minimum flow)	1, 2, 3	1 per pump	E	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 605 gpm and ≤ 984 gpm
h. Manual Initiation	1, 2, 3	2	C	SR 3.3.5.1.6	NA
3. High Pressure Core Spray (HPCS) System					
a. Reactor Vessel Water Level - Low Low, Level 2	1, 2, 3	4[(b)]	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ -58 inches
b. Drywell Pressure - High	1, 2, 3	4[(b)]	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≤ 1.88 psig
c. Reactor Vessel Water Level - High, Level 8	1, 2, 3	2	C	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≤ 56.0 inches
d. Condensate Storage Tank Level - Low	1, 2, 3	2	D	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 448 ft 1 inch elevation

(a) Deleted

(b) Also required to initiate the associated DG.

(c) Deleted

Table 3.3.5.1-1 (page 4 of 5)
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. HPCS System					
e. Suppression Pool Water Level - High	1, 2, 3	2	D	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≤ 466 ft 11 inches elevation
f. HPCS System Flow Rate - Low (Minimum Flow)	1, 2, 3	1	E	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 1200 gpm and ≤ 1512 gpm
g. Manual Initiation	1, 2, 3	2	C	SR 3.3.5.1.6	NA
4. Automatic Depressurization System (ADS) Trip System A					
a. Reactor Vessel Water Level - Low Low Low, Level 1	1, 2[(d)], 3[(d)]	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ -142.3 inches
b. ADS Initiation Timer	1, 2[(d)], 3[(d)]	1	G	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.6	≤ 115.0 seconds
c. Reactor Vessel Water Level - Low, Level 3 (Permissive)	1, 2[(d)], 3[(d)]	1	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 9.5 inches
d. LPCS Pump Discharge Pressure - High	1, 2[(d)], 3[(d)]	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 119 psig and ≤ 171 psig
e. LPCI Pump A Discharge Pressure - High	1, 2[(d)], 3[(d)]	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.6	≥ 116 psig and ≤ 134 psig

(a) Deleted

(d) 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.	Immediately
	AND		
	B.2	Calculate DRAIN TIME.	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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	D.1 Declare HPCS system inoperable. OR D.2 Align the HPCS pump suction to the suppression pool.	1 hour 1 hour
E. As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	E.1 Restore channel to OPERABLE status.	24 hours
F. Required Action and associated Completion Time of Condition C, D, or E not met.	F.1 Declare associated 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
SR 3.3.5.2.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program

Table 3.3.5.2-1 (page 1 of 2)
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. Low Pressure Coolant Injection-A (LPCI) and Low Pressure Core Spray (LPCS) Subsystems					
a. Reactor Vessel Pressure - Low (Injection Permissive)	4, 5	1 per valve[(a)]	C	SR 3.3.5.2.2	≤ 492 psig
b. LPCS Pump Discharge Flow - Low (Minimum Flow)	4, 5	1[(a)]	E	SR 3.3.5.2.2	≥ 668 gpm and ≤ 1067 gpm
c. LPCI Pump A Discharge Flow - Low (Minimum Flow)	4, 5	1[(a)]	E	SR 3.3.5.2.2	≥ 605 gpm and ≤ 984 gpm
d. Manual Initiation	4, 5	2[(a)]	E	SR 3.3.5.2.3	NA
2. LPCI B and LPCI C Subsystems					
a. Reactor Vessel Pressure - Low (Injection Permissive)	4, 5	1 per valve[(a)]	C	SR 3.3.5.2.2	≤ 492 psig
b. LPCI Pumps B & C Discharge Flow - Low (Minimum Flow)	4, 5	1 per pump[(a)]	E	SR 3.3.5.2.2	≥ 605 gpm and ≤ 984 gpm
c. Manual Initiation	4, 5	2[(a)]	E	SR 3.3.5.2.3	NA

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

Table 3.3.5.2-1 (page 2 of 2)
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
3. High Pressure Core Spray (HPCS) System					
a. Condensate Storage Tank Level - Low	4[b], 5[b]	1[a]	D	SR 3.3.5.2.2	≥ 448 ft 1 inch elevation
b. HPCS System Flow Rate - Low (Minimum Flow)	4, 5	1[a]	E	SR 3.3.5.2.2	≥ 1200 gpm and ≤ 1512 gpm
4. Residual Heat Removal (RHR) Shutdown Cooling (SDC) System Isolation					
a. Reactor Vessel Water Level - Low, Level 3	(c)	2 in one trip system	B	SR 3.3.5.2.1 SR 3.3.5.2.2	≥ 9.5 inches
5. Reactor Water Cleanup (RWCU) System Isolation					
a. Reactor Vessel Water Level - Low Low, Level 2	(c)	2 in one trip system	B	SR 3.3.5.2.2	≥ -58 inches

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

(b) When HPCS is OPERABLE for compliance with LCO 3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control," and aligned to the condensate storage tank.

(c) 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 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.	1 hour from discovery of loss of RCIC initiation capability
	AND		
	B.2	Place channel in trip.	24 hours
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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
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 4; and (b) for up to 6 hours for Functions 1 and 3 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	Perform CHANNEL FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.3.3	Perform CHANNEL CALIBRATION.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.3.4	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, Level 2	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	≥ -58 inches
2. Reactor Vessel Water Level - High, Level 8	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	≤ 56 inches
3. Condensate Storage Tank Level - Low	2	D	SR 3.3.5.3.1 SR 3.3.5.3.2 SR 3.3.5.3.3 SR 3.3.5.3.4	≥ 447 ft 7 inches elevation
4. Manual Initiation	2	C	SR 3.3.5.3.4	NA

Table 3.3.6.1-1 (page 5 of 6)
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. RHR SDC System Isolation					
a. Pump Room Area Temperature - High	3	1 per room	F	SR 3.3.6.1.3 SR 3.3.6.1.4 SR 3.3.6.1.6	≤ 150°F
b. Pump Room Area Ventilation Differential Temperature - High	3	1 per room	F	SR 3.3.6.1.3 SR 3.3.6.1.4 SR 3.3.6.1.6	≤ 70°F
c. Heat Exchanger Area Temperature - High	3	1 per room	F	SR 3.3.6.1.3 SR 3.3.6.1.4 SR 3.3.6.1.6	
Room 505 Area					≤ 140°F
Room 507 Area					≤ 160°F
Room 605 Area					≤ 150°F
Room 606 Area					≤ 140°F
d. Reactor Vessel Water Level - Low, Level 3	3	2	J	SR 3.3.6.1.1 SR 3.3.6.1.2 SR 3.3.6.1.4 SR 3.3.6.1.6	≥ 9.5 inches
e. Reactor Vessel Pressure - High	1, 2, 3	1	F	SR 3.3.6.1.2 SR 3.3.6.1.4 SR 3.3.6.1.6	≤ 135 psig
f. Manual Initiation	1, 2, 3	2	G	SR 3.3.6.1.6	NA

(d) Deleted

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 Low, Level 2	1, 2, 3	2[(c)]	SR 3.3.6.2.2 SR 3.3.6.2.3 SR 3.3.6.2.4	≥ -58 inches
2. Drywell Pressure - High	1, 2, 3	2[(c)]	SR 3.3.6.2.2 SR 3.3.6.2.3 SR 3.3.6.2.4	≤ 1.88 psig
3. Reactor Building Vent Exhaust Plenum Radiation - High	1, 2, 3	2	SR 3.3.6.2.1 SR 3.3.6.2.2 SR 3.3.6.2.3 SR 3.3.6.2.4	≤ 16.0 mR/hr
4. Manual Initiation	1, 2, 3	4	SR 3.3.6.2.4	NA

(a) Deleted

(b) Deleted

(c) Also required to initiate the associated LOCA Time Delay Relay Function pursuant to LCO 3.3.5.1.

Table 3.3.7.1-1 (page 1 of 1)
Control Room Emergency Filtration System 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 Low, Level 2	1, 2, 3	2	B	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3 SR 3.3.7.1.4	≥ -58 inches
2.	Drywell Pressure - High	1, 2, 3	2	C	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3 SR 3.3.7.1.4	≤ 1.88 psig
3.	Reactor Building Vent Exhaust Plenum Radiation - High	1, 2, 3	2	B	SR 3.3.7.1.1 SR 3.3.7.1.2 SR 3.3.7.1.3 SR 3.3.7.1.4	≤ 16.0 mR/hr

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS), 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 six safety/relief valves shall be OPERABLE.

APPLICABILITY: MODE 1,
MODES 2 and 3, except 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 HPCS.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One low pressure ECCS injection/spray subsystem inoperable.	A.1 Restore low pressure ECCS injection/spray subsystem to OPERABLE status.	7 days[1]
B High Pressure Core Spray (HPCS) System inoperable.	B.1 Verify by administrative means RCIC System is OPERABLE when RCIC System is required to be OPERABLE. AND B.2 Restore HPCS System to OPERABLE status.	Immediately 14 days

[1] The Completion Time that one train of RHR (RHR-A) can be inoperable as specified by Required Action A.1 may be extended beyond the 7 day completion time up to 7 days to support restoration of RHR-A following pump and motor replacement. This footnote will expire at 23:59 PST February 28, 2019.

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

3.5.2 Reactor Pressure Vessel (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 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

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

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		
	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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
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
SR 3.5.2.2	Verify, for a required low pressure ECCS injection/spray subsystem, the suppression pool water level is ≥ 18 ft 6 inches.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.3	Verify, for a required High Pressure Core Spray (HPCS) System, the: a. Suppression pool water level is ≥ 18 ft 6 inches; or b. Condensate storage tank (CST) water level is ≥ 16.5 ft in a single CST or ≥ 10.5 ft in each CST.	In accordance with the Surveillance Frequency Control Program

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.5.2.4	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 3.5.2.5	----------NOTE---------- Not required to be met for system vent flow paths opened under administrative controls. ----------	
	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 3.5.2.6	----------NOTE---------- Injection into the vessel is not required. ----------	
	Operate the required ECCS injection/spray subsystem for ≥ 10 minutes.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.7	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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.2.8	----------NOTE---------- Vessel injection/spray may be excluded. ----------	
	Verify the required LPCI or LPCS subsystem actuates on a manual initiation signal or the required HPCS subsystem can be manually operated.	In accordance with the Surveillance Frequency Control Program

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS), 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 Core Spray System is OPERABLE.	Immediately
	AND		
	A.2	Restore RCIC System to OPERABLE status.	14 days
B. Required Action and associated Completion Time not met.	B.1	Be in MODE 3.	12 hours
	AND		
	B.2	Reduce reactor steam dome pressure to ≤ 150 psig.	36 hours

3.6 CONTAINMENT SYSTEMS

3.6.1.3 Primary Containment Isolation Valves (PCIVs)

LCO 3.6.1.3 Each PCIV, except reactor building-to-suppression chamber vacuum breakers, shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3

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 PCIVs.
4. Enter applicable Conditions and Required Actions of LCO 3.6.1.1, "Primary Containment," when PCIV leakage results in exceeding overall containment leakage rate acceptance criteria.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ----------NOTE---------- Only applicable to penetration flow paths with two PCIVs. ---------- One or more penetration flow paths with one PCIV inoperable for reasons other than Condition D.	A.1 Isolate the affected penetration flow path by use of at least one closed and de-activated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured. AND	4 hours except for main steam line AND 8 hours for main steam line

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One or more secondary containment bypass leakage rate, MSIV leakage rate, or hydrostatically tested lines leakage rate not within limit.	D.1 Restore leakage rate to within limit.	4 hours for hydrostatically tested line leakage not on a closed system AND 4 hours for secondary containment bypass leakage AND 8 hours for MSIV leakage AND 72 hours for hydrostatically tested line leakage on a closed system
E. Required Action and associated Completion Time of Condition A, B, C, or D not met.	E.1 Be in MODE 3. AND E.2 Be in MODE 4.	12 hours 36 hours

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Secondary containment inoperable.	A.1 Restore secondary containment to OPERABLE status.	4 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 ----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- Be in MODE 3.	12 hours

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

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.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
B. ----------NOTE---------- Only applicable to penetration flow paths with two isolation valves. ---------- One or more penetration flow paths with two SCIVs inoperable.	B.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.	4 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. AND C.2 Be in MODE 4.	12 hours 36 hours

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

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.	B.1 ----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- Be in MODE 3.	12 hours
C. Two SGT subsystems inoperable.	C.1 ----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.3.1	Operate each SGT subsystem for ≥ 15 continuous minutes with heaters operating.	In accordance with the Surveillance Frequency Control Program
SR 3.6.4.3.2	Perform required SGT filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.6.4.3.3	Verify each SGT subsystem actuates on an actual or simulated initiation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.6.4.3.4	Verify each SGT filter cooling recirculation valve can be opened and the fan started.	In accordance with the Surveillance Frequency Control Program

3.7 PLANT SYSTEMS

3.7.3 Control Room Emergency Filtration (CREF) System

LCO 3.7.3 Two CREF subsystems shall be OPERABLE.

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

APPLICABILITY: MODES 1, 2, and 3

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One CREF subsystem inoperable for reasons other than Condition B.	A.1	Restore CREF subsystem to OPERABLE status.	7 days
B. One or more CREF subsystems inoperable due to inoperable CRE boundary.	B.1	Initiate action to implement mitigating actions.	Immediately
	AND		
	B.2	Verify mitigating actions ensure CRE occupant exposures to radiological, chemical, and smoke hazards will not exceed limits.	24 hours
	AND		
	B.3	Restore CRE boundary to OPERABLE status.	90 days

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 ----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- Be in MODE 3.	12 hours
D. Two CREF subsystems inoperable for reasons other than Condition B.	D.1 ----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- Be in MODE 3.	12 hours

3.7 PLANT SYSTEMS

3.7.4 Control Room Air Conditioning (AC) System

LCO 3.7.4 Two control room AC subsystems shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One control room AC subsystem inoperable.	A.1 Restore control room AC subsystem to OPERABLE status.	30 days
B. Two control room AC subsystems inoperable.	B.1 Verify control room area temperature < 90°F. AND	Once per 4 hours
	B.2 Restore one control room AC subsystem to OPERABLE status.	72 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 ----------NOTE---------- LCO 3.0.4.a is not applicable when entering MODE 3. ---------- Be in MODE 3.	 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.4.1	Verify each control room AC subsystem has the capability to remove the assumed heat load.	In accordance with the Surveillance Frequency Control Program

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2 Initiate action to restore required offsite power circuit to OPERABLE status.	Immediately
B. Division 1 or 2 required DG inoperable.	B.1 Initiate action to restore required DG to OPERABLE status.	Immediately
C. Required Division 3 DG inoperable.	C.1 Declare High Pressure Core Spray System inoperable.	72 hours

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One or more required DC electrical power subsystems inoperable, for reasons other than Condition A. OR Required Action and Completion Time of Condition A not met.	B.1 Declare affected required feature(s) inoperable. OR B.2 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.5.1	----------NOTE---------- The following SRs are not required to be performed: SR 3.8.4.2, and SR 3.8.4.3. ---------- For DC electrical power subsystems required to be OPERABLE the following SRs are applicable: SR 3.8.4.1, SR 3.8.4.2, and SR 3.8.4.3.	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.8 Distribution Systems - Shutdown

LCO 3.8.8 The necessary portions of the Division 1, Division 2, and Division 3 AC and DC electrical power distribution subsystems shall be OPERABLE to support equipment required to be OPERABLE.

APPLICABILITY: MODES 4 and 5.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required AC or DC electrical power distribution subsystems inoperable.	A.1 Declare associated supported required feature(s) inoperable. OR	Immediately
	A.2.1 Initiate actions to restore required AC and DC electrical power distribution subsystems to OPERABLE status. AND	Immediately
	A.2.2 Declare associated required shutdown cooling subsystem(s) inoperable and not in operation.	Immediately

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 251 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-21

ENERGY NORTHWEST

COLUMBIA GENERATING STATION

DOCKET NO. 50-397

1.0 INTRODUCTION

By application dated October 23, 2017 (Reference 1), as supplemented by letters dated November 15, 2017, and June 27, 2018 (References 2 and 3, respectively), Energy Northwest (the licensee) requested to adopt Technical Specifications Task Force (TSTF) Traveler TSTF-542, Revision 2, "Reactor Pressure Vessel Water Inventory Control" (Reference 4), for the Columbia Generating Station (Columbia). The final safety evaluation (SE) for TSTF-542, Revision 2, was approved by the U.S. Nuclear Regulatory Commission (NRC, the Commission) on December 20, 2016 (Reference 5).

The proposed changes would replace existing technical specification (TS) requirements associated with "operations with a potential for draining the reactor vessel" (OPDRVs), with revised TSs providing alternative requirements for Reactor Pressure Vessel (RPV) Water Inventory Control (WIC). These alternative requirements would protect the Columbia 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 "DRAIN TIME" would be added to the Columbia TSs, Section 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 proposed several Columbia plant-specific variations from the TS changes described in the applicable parts of TSTF-542, Revision 2, or the NRC-approved TSTF-542 SE. These are explained and evaluated, respectively, in Sections 2.2.5 and 3.5 of this SE.

The supplemental letter dated June 27, 2018, provided additional information that clarified the application, 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 January 16, 2018 (83 FR 2227).

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 irradiated fuel (TAF). These penetrations provide entry for control rods, recirculation flow, and shutdown cooling (SDC). Since 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 Mode 1 (Power Operation – Reactor Mode Switch in Run), Mode 2 (Startup – Reactor Mode Switch in Refuel[1] or Startup/Hot Standby), and Mode 3 (Hot Shutdown[1] - Reactor Mode Switch in Shutdown and average reactor coolant temperature greater than (>) 200 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 less than or equal to (≤) 200 °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 greater than or equal to (≥) 22 feet over the top of the RPV flange, and the spent fuel storage pool gates are removed (existing TS Limiting Condition for Operation (LCO) 3.5.2).

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, 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 potential sudden loss of large volumes of water from a LOCA are not expected, operators monitor for BWR RPV water level decrease from potential 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 Columbia TSs contain specifications that are applicable during an OPDRV, or require suspension of OPDRVs if

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

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 proposed TS 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 TSs.

2.2 Proposed TS Changes

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

Section 2.2.2 of this SE 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," (3) the renumbering of existing TS 3.3.5.2, "Reactor Core Isolation Cooling (RCIC) System Instrumentation," to 3.3.5.3, and (4) the proposed revision to TS Table 3.3.6.1-1, "Primary Containment Isolation Instrumentation." These sections are evaluated in Sections 3.2 and 3.4 of this SE.

Section 2.2.3 of this SE describes the proposed revisions to TS 3.5, "Emergency Core Cooling Systems (ECCS) and Reactor Core Isolation Cooling (RCIC) System" (proposed to be titled, "Emergency Core Cooling Systems (ECCS), RPV Water Inventory Control, and Reactor Core Isolation Cooling (RCIC) System"), including the proposed revisions to TS 3.5.2 "ECCS - Shutdown" (Proposed to be titled, "Reactor Pressure Vessel (RPV) Water Inventory Control") (evaluated below in SE Section 3.3.).

In the licensee's amendment submittals the intended title change for TS 3.5.2 was not applied correctly to the footnotes associated with the final TS pages of 3.3.5.2-4, and 3.3.5.2-5. This error constitutes an editorial and administrative correction that will be made by the NRC in the final TS pages that are issued with this amendment, and the final TS page footnotes for 3.3.5.2-4, 3.3.5.2-5 will accurately reflect the proper title for TS 3.5.2 as "Reactor Pressure Vessel (RPV) Water Inventory Control".

Section 2.2.4 of this SE describes the proposed deletion of existing TS references to OPDRVs (evaluated below in Section 3.6). Section 2.2.5 describes Columbia plant-specific variations to TSTF-542, Revision 2 (evaluated below in SE Section 3.5).

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 devices 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 existing and proposed changes to the Columbia TS, Section 3.3, "Instrumentation."

2.2.2.1 Table 3.3.5.1, "Emergency Core Cooling System (ECCS) Instrumentation"

Proposed changes to TS 3.3.5.1 include the deletion of Note 1 in Required Actions B.1, B.2, 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, the applicability in Modes 4 and 5 was proposed for deletion 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. Low Pressure Coolant Injection - A (LPCI) and Low Pressure Core Spray (LPCS) Subsystems:

   a. Reactor Vessel Water Level - Low, Level 1
   c. LPCS Pump Start - LOCA Time Delay Relay
   d. LPCI Pump A Start - LOCA Time Delay Relay
   e. LPCI Pump A Start - LOCA/LOOP Time Delay Relay
   f. Reactor Vessel Pressure - Low (Injection Permissive)
   g. LPCS Pump Discharge Flow - Low (Minimum Flow)
   h. LPCI Pump A Discharge Flow - Low (Minimum Flow)
   i. Manual Initiation

2. LPCI B and LPCI C Subsystems:

   a. Reactor Vessel Water Level - Low, Level 1
   c. LPCI Pump B Start - LOCA Time Delay Relay
   d. LPCI Pump C Start - LOCA Time Delay Relay
   e. LPCI Pump B Start - LOCA/LOOP Time Delay Relay
   f. Reactor Vessel Pressure - Low (Injection Permissive)
   g. LPCI Pumps B & C Discharge Flow - Low (Minimum Flow)
   h. Manual Initiation

3. High Pressure Core Spray (HPCS) System;

   a. Reactor Vessel Water Level - Low, Level 2
   c. Reactor Vessel Water Level - High, Level 8
   d. Condensate Storage Tank - Low
   f. HPCS System Flow Rate - Low (Minimum Flow)
   g. Manual Initiation

TS Table 3.3.5.1-1, Footnote (a), which states, "When associated subsystem(s) are required to be OPERABLE," would be deleted. Also, Footnote (c), which states, "When HPCS is OPERABLE for compliance with LCO 3.5.2, 'ECCS - Shutdown,' and aligned to the condensate storage tank while tank water level is not within the limit of SR 3.5.2.2," would be deleted. Both deleted footnotes would be replaced with "Deleted."

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 new TS requirements. 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

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.	Immediately
		AND		
		B.2	Calculate DRAIN TIME.	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	Declare HPCS system inoperable.	1 hour
		OR		
		D.2	Align the HPCS pump suction to the suppression pool.	1 hour
E.	As required by Required Action A.1 and referenced in Table 3.3.5.2-1.	E.1	Restore Channel to OPERABLE status.	24 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. Required Action and associated Completion Time of Condition C, D, or E not met.	F.1 Declare associated 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
SR 3.3.5.2.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.	In accordance with the Surveillance Frequency Control Program

The proposed TS Table 3.3.5.2-1, "RPV Water Inventory Control Instrumentation," is shown below and would include 3 footnotes.

Table 3.3.5.2-1
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. Low Pressure Coolant Injection – A (LPCI) and Low Pressure Core Spray (LPCS) Subsystems					
a. Reactor Vessel Pressure – Low (Injection Permissive)	4, 5	1 per valve[(a)]	C	SR 3.3.5.2.2	≤ 492 psig
b. LPCS Pump Discharge Flow – Low (Minimum Flow)	4, 5	1[(a)]	E	SR 3.3.5.2.2	≥ 668 gpm and ≤ 1067 gpm
c. LPCI Pump A Discharge Flow – Low (Minimum Flow)	4, 5	1[(a)]	E	SR 3.3.5.2.2	≥ 605 gpm and ≤ 984 gpm
d. Manual Initiation	4, 5	2[(a)]	E	SR 3.3.5.2.3	NA
2. LPCI B and LPCI C Subsytems					
a. Reactor Vessel Pressure – Low (Injection Permissive)	4, 5	1 per valve[(a)]	C	SR 3.3.5.2.2	≤ 492 psig
b. LPCI Pumps B & C Discharge Flow – Low (Minimum Flow)	4, 5	1 per pump[(a)]	E	SR 3.3.5.2.2	≥ 605 gpm and ≤ 984 gpm
c. Manual Initiation	4, 5	2[(a)]	E	SR 3.3.5.2.3	NA

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 Core Spray (HPCS) System					
a. Condensate Storage Tank Level – Low	4[(b)], 5[(b)]			SR 3.3.5.2.2	≥ 448 ft 1 inch elevation
b. HPCS System Flow Rate – Low (Minimum Flow)	4, 5	1[(a)]	D	SR 3.3.5.2.2	≥ 1200 gpm and ≤ 1512 gpm
		1[(a)]	E		
4. Residual Heat Removal (RHR) Shutdown Cooling (SDC) System Isolation					
a. Reactor Vessel Water Level - Low Level 3	(c)	2 in one trip system	B	SR 3.3.5.2.1 SR 3.3.5.2.2	≥ 9.5 inches
5. Reactor Water Cleanup (RWCU) System Isolation					
a. Reactor Vessel Water Level - Low Low, Level 2	(c)	2 in one trip system	B	SR 3.3.5.2.2	≥ -58 inches

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

(b) When HPCS is OPERABLE for compliance with LCO 3.5.2, "RPV Water Inventory Control," and aligned to the condensate storage tank.

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

2.2.2.3 TS 3.3.5.2, "Reactor Core Isolation Cooling (RCIC) System Instrumentation"

The existing TS 3.3.5.2, "Reactor Core Isolation Cooling (RCIC) System Instrumentation Isolation," and its subsections would be renumbered to TS 3.3.5.3 in order to maintain the TS numbering conventions. This also included the renumbering of TS Table 3.3.5.2-1, "Reactor Core Isolation Cooling System Instrumentation."

2.2.2.4 TS 3.3.6.1, "Primary Containment Isolation Instrumentation"

In TS Table 3.3.6.1-1, Function 5.d, "RHR [Residual Heat Removal] SDC System Isolation," "Reactor Vessel Water Level - Low, Level 3," the applicability in Modes 4 and 5 was proposed for deletion. Also, Footnote (d) to Table 3.3.6.1-1 was proposed to be deleted, as it is applicable only to Function 5.d during Modes 4 and 5. Footnote (d) is related to RHR SDC System integrity. Footnote (d) is replaced with "Deleted". This function would move to the new TS Table 3.3.5.2-1, Function 4.a, as shown in Section 2.2.2.2 of this SE.

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

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

The title of Columbia TS Section 3.5.2 would be revised from "ECCS - Shutdown" to "Reactor Pressure Vessel (RPV) Water Inventory Control," and TS 3.5.2 would be revised as follows:

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

AND

One 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 hours.	C.1 Verify secondary containment boundary is capable of being established in less than the DRAIN TIME. AND C.2 Verify each secondary containment penetration flow path is capable of being isolated in less than the DRAIN TIME. AND C.3 Verify one standby gas treatment subsystem is capable of being placed in operation in less than the DRAIN TIME.	4 hours 4 hours 4 hours
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. AND D.2 Initiate action to establish secondary containment boundary. AND	 Immediately Immediately

CONDITION	REQUIRED ACTION	COMPLETION TIME
	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

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 a required low pressure ECCS injection/spray subsystem, the suppression pool water level is ≥ 18 ft 6 inches.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.3	Verify, for a required High Pressure Core Spray (HPCS) System, the: a. Suppression pool water level is ≥ 18 ft 6 inches; or b. Condensate storage tank (CST) water level is ≥ 16.5 ft in a single CST or ≥ 10.5 ft in each CST.	In accordance with the Surveillance Frequency Control Program

SR 3.5.2.4	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 3.5.2.5	----------NOTE---------- Not required to be met for system vent flow paths opened under administrative controls. ----------	
	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 3.5.2.6	----------NOTE---------- Injection into the vessel is not required. ----------	
	Operate the required ECCS injection/spray subsystem for ≥ 10 minutes.	In accordance with the Surveillance Frequency Control Program
SR 3.5.2.7	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 3.5.2.8	----------NOTE---------- Vessel injection/spray may be excluded. ----------	
	Verify the required LPCI or LPCS subsystem actuates on a manual initiation signal or the required HPCS subsystem can be manually operated.	In accordance with the Surveillance Frequency Control Program

2.2.4 Deletion of Reference to OPDRVs

In the application dated October 23, 2017 (Reference 1), the licensee proposed to revise existing TS requirements related to "operations with a potential for draining the reactor vessel" or "OPDRVs," with new requirements on RPV WIC that will protect TS Safety Limit 2.1.1.3. To remain consistent with TSTF-542, Revision 2, all references to the term OPDRVs in the Columbia TSs will be deleted. The TS location of these references are summarized as follows:

Columbia TS LCO	Location of OPDRVs References
3.3.6.1, "Primary Containment Isolation Instrumentation"	Table 3.3.6.1-1, Footnote (d) - existing text is replaced with "Deleted" (Previously described in Section 2.2.2.4 of this SE)
3.3.6.2, "Secondary Containment Isolation Instrumentation"	Table 3.3.6.2-1, Footnote (a) - existing text is replaced with "Deleted"
3.3.7.1, "Control Room Emergency Filtration (CREF) System Instrumentation"	Table 3.3.7.1-1, Footnote (a) – no text replacement
3.6.1.3, "Primary Containment Isolation Valves (PCIVs)"	Applicability is deleted which states: "When associated instrumentation is required to be OPERABLE per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation." Condition F MODE 1, 2, or 3 – deleted from Condition E
3.6.4.1, "Secondary Containment"	Applicability, Condition C MODE 1, 2, or 3 – deleted from Condition A
3.6.4.2, "Secondary Containment Isolation Valves (SCIVs)"	Applicability, Condition D MODE 1, 2, or 3 – deleted from Condition C
3.6.4.3, "Standby Gas Treatment (SGT) System"	Applicability, Condition C, Condition E MODE 1, 2, or 3 – deleted from Condition B With the deletion of Condition, Required Action, and Completion Time for C, existing Condition, Required Action, and Completion Time for D is renumbered as C. MODE 1, 2, or 3 – deleted from existing Condition D (new Condition C)

3.7.3, "Control Room Emergency Filtration (CREF) System"	Applicability, Conditions D and F MODE 1, 2, or 3 – deleted from Conditions B and C With the deletion of Condition, Required Action, and Completion Time for D, existing Condition, Required Action, and Completion Time for E is renumbered as D MODE 1, 2, or 3 – deleted from existing Condition E (new Condition D)
3.7.4, "Control Room Air Conditioning (A/C) System"	Applicability, Conditions D and E MODE 1, 2, or 3 – deleted from Condition C
3.8.2, "AC Sources – Shutdown"	Required Action and Completion Time for A.2.1. (existing Required Actions A.2.2 is renumbered as A.2) Required Action and Completion Time for B.1. (existing Required Actions B.2 is renumbered as B.1)
3.8.5, "DC Sources – Shutdown"	Required Action and Completion Time for B.2.1. (existing Required Actions B.2.2 is renumbered as B.2)
3.8.8, "Distribution Systems – Shutdown"	Required Action and Completion Time for A.2.1 (existing Required Actions A.2.2 and A.2.3 are renumbered as A.2.1 and A.2.2, respectively)

2.2.5 Columbia Plant-Specific TSTF-542 TS Variations

In Attachment 1 of Section 2.2 of the application dated October 23, 2017, the licensee identified several Columbia plant-specific TS variations from TSTF-542, Revision 2 (Reference 4), or the NRC-approved TSTF-542 SE (Reference 5). The licensee stated that these variations do not affect the applicability of the TSTF-542, Revision 2 or the NRC staff's SE. The NRC staff has determined that the licensee's proposed variations can be characterized as either administrative or technical. Section 3.5 of this SE includes the staff's technical evaluation of each of these technical variations.

2.2.5.1 Variation 1, TS Table 3.3.5.1-1, LPCS/LPCI LOCA Time Delay Relays

The ECCS Instrumentation for Columbia includes additional Function 1.c, "LPCS Pump Start - LOCA Time Delay Relay," and Function 1.d, "LPCI Pump A Start - LOCA Time Delay Relay." Also, the ECCS Instrumentation for Columbia includes additional Function 2.c, "LPCI Pump B Start - LOCA Time Delay Relay," and Function 2.d, "LPCI Pump C Start – LOCA Time Delay Relay."

The Columbia LOCA Time Delay Relay Function is only necessary when the power is being supplied from the TR-S transformer. The purpose of time delay relays is to stagger the start of the ECCS pumps that are in Divisions 1 and 2, thus, limiting the starting transients on the 4.16 kilovolt (kV) emergency buses. The licensee proposed removing the LOCA time delay relay function.

2.2.5.2 Variation 2, TS Table 3.3.5.1-1, Function 2.f, Reactor Vessel Pressure - Low (Injection Permissive)

The Columbia ECCS Instrumentation Function 2.f, "Reactor Vessel Pressure - Low (Injection Permissive)," is equivalent to Function 2.d, "Reactor Steam Dome Pressure - Low (Injection Permissive)," in NUREG-1434, Standard Technical Specifications, General Electric BWR/6 Plants, Revision 4 (Reference 6). As noted on page 20 of TSTF-542, Revision 2, NUREG-1434 does not include the Mode 4 and 5 applicability of this function, which was an apparent oversight in the development of the NUREG. However, the Columbia TS does contain the Mode 4 and 5 applicability for this function. Consistent with the intent of TSTF-542, the Mode 4 and 5 requirements are deleted from TS 3.3.5.1 (see also discussion for the new TS 3.3.5.2) for this function.

2.2.5.3 Variation 3, TS Table 3.3.5.2-1, LPCS/LPCI, HPCS, and RWCU Channel Checks

The current plant design (Table 3.3.5.1-1) does not include indication to perform a channel check on the following instrument functions. Therefore, the proposed TS SR 3.3.5.2.1 is not included for these eight functions.

Table 3.3.5.2-1, Function 1, LPCI A and LPCS Subsystems:

- Function 1.a, Reactor Vessel Pressure - Low (Injection Permissive)
- Function 1.b, LPCS Pump Discharge Flow - Low (Minimum Flow)
- Function 1.c, LPCI Pump A Discharge Flow - Low (Minimum Flow)

Table 3.3.5.2-1, Function 2, LPCI B and LPCI C Subsystems:

- Function 2.a, Reactor Vessel Pressure - Low (Injection Permissive)
- Function 2.b, LPCI Pumps B & C Discharge Flow - Low (Minimum Flow)

Table 3.3.5.2-1, Function 3, HPCS System

- Function 3.a, Condensate Storage Tank Level - Low
- Function 3.b, HPCS System Flow Rate - Low (Minimum Flow)

Table 3.3.5.2-1, Function 5, RWCU System

- Function 5.a, Reactor Vessel Water Level - Low, Level 2

2.2.5.4 Variation 4, Deletion of HPCS Functions; Manual Initiation and RPV Water Level High, Level 8

TS Table 3.3.5.2-1, Function 3.a, "Reactor Vessel Water Level - High, Level 8," and Function 3.e, "Manual Initiation," that appear in TSTF-542, Revision 2 are not included in the

proposed technical specifications. This corrects an error in TSTF-542 that affects BWR/5 and BWR/6 ECCS instrumentation requirements. Columbia Generating Station is a BWR/5.

Also, the TSTF-542 markups of NUREG-1434 contain LCO 3.3.5.2 Actions, Condition E that is associated with TS Table 3.3.5.2-1, Function 3.a, "Reactor Vessel Water Level - High, Level 8." Since this function is being deleted, Condition E is also being deleted from the table; and subsequent conditions are being relettered for proposed new LCO 3.3.5.2.

2.2.5.5 Variation 5, TS Table 3.3.7.1-1, Reactor Building Vent Exhaust Plenum

Columbia TS Table 3.3.7.1-1 contains Function 3, "Reactor Building Vent Exhaust Plenum Radiation - High." This function will isolate the control room emergency filtration system on high secondary containment exhaust radiation. This function is modified to remove the applicability during operations with a potential for draining the reactor vessel (Footnote (a)). NUREG-1434 does not contain this function; however, the removal of references to OPDRVs is consistent with the guidance provided in TSTF-542, Revision 2.

2.2.5.6 Variation 6, ECCS Injection/Spray Subsystem through the Recirculation Line

In TSTF-542, Revision 2, the NUREG-1434 markup for SR 3.5.2.6 states: "Operate the required ECCS injection/spray subsystem through the recirculation line for ≥ 10 minutes." Energy Northwest proposes to modify the TSTF-542 markups of SR 3.5.2.6 by deleting "through the recirculation line" and adding a note that states: "Injection into the vessel is not required." At Columbia, only the LPCI A and B subsystems can inject through the reactor recirculation lines, which would preclude use of other ECCS subsystems to meet LCO 3.5.2.

2.2.5.7 Variation 7, TS 3.6.1.3 PCIVs Modes for Condition E

The applicability of Columbia TS 3.6.1.3 is modified to only apply to Modes 1, 2, and 3. Columbia TS Condition E contains the phrase "in Modes 1, 2, or 3." This phrase is proposed to be deleted as it is no longer needed.

2.2.5.8 Variation 8, Removal of Mode 1, 2 and 3 from Secondary Containment, SCIVs, SGT, CREF, and Control Room A/C System Technical Specifications

In NUREG-1434, the applicability for the above listed TSs include "[During movement of [recently] irradiated fuel assemblies in the [primary or secondary containment]". The Columbia TSs do not contain this applicability statement as it was removed by Amendment No. 199. The existing applicability for Columbia is during Modes 1, 2, and 3, and during OPDRVs. Consistent with TSTF-542, Revision 2, the licensee is proposing to delete "during OPDRVs" from the applicability. Thus, the remaining applicability is Modes 1, 2, and 3. The following conditions contain the phrase "in Mode 1, 2, or 3." This phrase is proposed to be deleted as it is no longer needed for the following LCOs.

- TS 3.6.4.1 Condition A
- TS 3.6.4.2 Condition C
- TS 3.6.4.3 Conditions B and D
- TS 3.7.3 Conditions B, C, and E
- TS 3.7.4 Condition C

2.2.5.9 Variation 9, Removal of Conditions from Secondary Containment, SCIVs, SGT, CREF, and Control Room A/C System Technical Specifications

Similarly, in NUREG-1434, a condition in the above listed TSs include, "... inoperable during movement of [recently] irradiation fuel assemblies in the [primary or secondary containment] or during OPDRVs." The equivalent condition in the Columbia TS reads, "... inoperable during OPDRVs." Since "during OPDRVs" is deleted from the applicability, the following conditions are deleted in their entirety since they are no longer required. These changes are consistent with TSTF-542, Revision 2. This change also results in renumbering remaining conditions.

- TS 3.6.4.1 Condition C
- TS 3.6.4.2 Condition D
- TS 3.6.4.3 Condition C and E
- TS 3.7.3 Conditions D and F
- TS 3.7.4 Conditions D and E

2.2.5.10 Variation 10, TS LCO 3.5.2, LPCI and Decay Heat Removal Note

In NUREG-1434, LCO 3.5.2 is modified by a Note regarding the LPCI subsystem being considered operable during alignment and operation for decay heat removal. This Note is modified by TSTF-542 to change "one" to "a". In the Columbia TSs, this Note modifies SR 3.5.2.4 (rather than the LCO). The verbiage is the same between the Columbia TS and NUREG-1434. To maintain consistency with the presentation in TSTF-542, Revision 2, the SR 3.5.2.4 Note will be deleted from the SR and moved to LCO 3.5.2 at the LCO level.

2.3 Applicable Regulatory Requirements

The regulation under Title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 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, "Technical specifications". 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 items in the following categories:

(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. Specifically, 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 items in the category of 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.

Pursuant to 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," whenever a holder of an operating license desires to amend the license, 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 governed in particular 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), how the TSs provide reasonable assurance that the health and safety of the public will not be endangered. Also, to issue an operating license, of which TSs are a part, the Commission must make the findings of 10 CFR 50.57, "Issuance of operating license," including the 10 CFR 50.57(a)(3)(i) finding that there is reasonable assurance that the activities authorized by the operating license can be conducted without endangering the health and safety of the public.

NUREG-1434, Revision 4 (Reference 6 and 7), contains the STS for BWR/6 plants and is part of the regulatory standardization effort. The NRC staff has prepared STS for each of the light-water reactor (LWR) nuclear designs. Columbia is a BWR/5 plant and is aligned with BWR/6 Standard Technical Specifications (STS) (NUREG-1434), without a setpoint control program.

The NRC staff's guidance for review of TSs is in Section 16, Revision 3, "Technical Specifications," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," dated March 2010 (Reference 8).

2.3.1 Columbia Applicable Design Requirements

The Columbia Final Safety Analysis Report (FSAR), Section 3.1, "Conformance with NRC General Design Criteria," contains an evaluation of the Columbia design basis as measured against the NRC General Design Criteria (GDC) for nuclear power plants, Appendix A, of 10 CFR Part 50 effective May 21, 1971, and subsequently amended July 7, 1971. The following criteria are related to this amendment and a discussion of them are found in the Columbia Updated FSAR, Section 3.1 (Reference 9).

Criterion 13 - Instrumentation and Control

Instrumentation shall be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges.

Criterion 14 - Reactor Coolant Pressure Boundary

The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

Criterion 16 - Containment Design

Reactor containment and associated systems shall be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

Criterion 30 - Quality of Reactor Coolant Pressure Boundary

Components which are part of the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested to the highest quality standards practical. Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage.

Criterion 33 - Reactor Coolant Makeup

A system to supply reactor coolant makeup for protection against small breaks in the reactor coolant pressure boundary shall be provided. The system safety function shall be to assure that specified acceptable fuel design limits are not exceeded as a result of reactor coolant loss due to leakage from the reactor coolant pressure boundary and rupture of small piping or other small components which are part of the boundary. The system shall be designed to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished using the piping, pumps, and valves used to maintain coolant inventory during normal reactor operation.

Criterion 35 – Emergency Core Cooling

A system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented, and (2) clad metal-water reaction is limited to negligible amounts.

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

3.0 TECHNICAL EVALUATION

Section 2.2 of this SE lists the proposed TS changes, as included in the licensee's letters dated October 23, 2017; November 15, 2017; and June 27, 2018 (References 1, 2, and 3, respectively), 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 "DRAIN TIME" Definition

As discussed in Section 2.2.1 of this SE, 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. For Columbia, the TS Safety Limit 2.1.1.3 requires the RPV water level to be greater than the top of active irradiated fuel.

The NRC staff reviewed the proposed DRAIN TIME definition from TSTF-542, Revision 2. For the purpose of NRC staff considerations, the term "break" describes 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 the information furnished by the licensee, the NRC staff has determined that the licensee is appropriately adopting the principles of DRAIN TIME, as specified in TSTF-542, Revision 2.

As part of this evaluation, the NRC staff reviewed requests for additional information used during the development of TSTF-542, Revision 2, which provided examples of bounding DRAIN TIME calculations for three examples: (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.

The NRC staff concluded that the licensee will use methods resulting in conservative calculations to determine RPV DRAIN TIME, thereby, protecting TS Safety Limit 2.1.1.3 which meets the requirements of 10 CFR 50.36(c)(3). Based on these considerations, the NRC staff has determined that the licensee's proposed addition of the DRAIN TIME definition to the Columbia TSs is acceptable.

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

The existing Columbia TS 3.3.5.2, "Reactor Core Isolation Cooling (RCIC) System Instrumentation," is renumbered as TS 3.3.5.3. This achieves consistency within the Columbia TSs and is acceptable.

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 functions 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 Columbia, reactor operators have alternate means, often requiring 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 development of TSTF-542, Revision 2. For Columbia, operators have manual push buttons that automatically align reactor injection for Modes 1, 2, and 3 (LPCS, LPCI, and HPCS subsystem). The licensee proposed to maintain manual push buttons that automatically aligns reactor injection for Modes 4 and 5 for LPCS and LPCI only; however, HPCS will be operated by manual alignment of components.

Specifically, the proposed new TS 3.3.5.2 supports operation of the ECCS with subsystems LPCI A, LPCI B, and LPCI C, LPCS, and HPCS, including manual alignment, when needed, as well as the system isolation of the RHR/SDC 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 LCO 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 LCO and Applicability

In the application dated October 23, 2017, the licensee proposed new TS 3.3.5.2 to provide alternative instrumentation requirements to support manual initiation of the ECCS injection/spray subsystem. This subsystem is required in revised TS 3.5.2 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 Table 3.3.5.1-1, TS Table 3.3.6.1-1, TS Table 3.3.6.2-1 and TS 3.3.7.1. The requirements from TS Table 3.3.5.1-1 and TS Table 3.3.6.1-1 would be consolidated into new TS 3.3.5.2. The OPDRVs requirements in TS Table 3.3.6.2-1, and TS Table 3.3.7.1-1 would be deleted, as discussed in Section 3.6 of this SE.

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.

Revision 2 of TSTF-542 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. The functions that are required in Modes 4 or 5, or during OPDRVs, are relocated to TS Table 3.3.5.2-1 from existing TS 3.3.5.1, "Emergency Core Cooling System (ECCS) Instrumentation," and TS 3.3.6.1, "Primary Containment Isolation Instrumentation." 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 NRC staff concluded that the licensee's proposed alternative is acceptable for Columbia since either HPCS, LPCS, or LPCI (or all three) subsystems would be available to perform the intended function to inject water into the RPV, which meets the intent of the NRC-approved TSTF-542, Revision 2.

3.2.2 Staff Evaluation of Proposed TS 3.3.5.2 Actions

As discussed in Section 2.2.2.2 of this SE, the NRC staff has reviewed the licensee's proposed new TS 3.3.5.2 Actions 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. The Actions are evaluated as follows.

> Action A would be applicable when one or more instrument channels are inoperable from TS 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 RPV pressure low – injection permissive functions necessary for ECCS injection/spray subsystem manual injection valve opening) would address an event in which the permissive is inoperable. The function must be placed in the trip condition within 1 hour. With the permissive function instrumentation in the trip condition, manual injection valve opening may now be performed using the preferred control board switches. This 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 evaluation and placing the channel in trip.
>
> Action D (concerning loss of adequate water supply for the HPCS system) addresses an event in which there is an inadequate water supply. The instrumentation functions have the ability to detect the low-water setpoint in the CST and actuate valves to realign HPCS suction water source to the suppression pool. Required Actions D.1 and D.2 are intended to ensure that appropriate actions are taken if multiple, inoperable channels within the same function result in a loss of automatic suction swap for the HPCS system from the CST to the suppression pool. The HPCS system must be declared inoperable

within 1 hour or the HPCS pump suction must be aligned to the suppression pool, since, if aligned, the function is already performed. The 1-hour completion time is acceptable because it minimizes the risk of HPCS being needed without an adequate water source while allowing time for restoration or alignment of HPCS pump suction to the suppression pool.

Action E (concerning LPCS/LPCI pump discharge flow [minimum flow] functions and HPCS system flow [minimum flow] function) addresses an event in which the minimum flow is inoperable since there is a 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 to ensure the pump does not overheat.

Action E is also applicable to the LPCS/LPCI manual initiation push buttons. If a manual initiation function is inoperable, the ECCS subsystem pumps can be started manually and the valves can be opened manually, but this is not the preferred condition.

The 24-hour completion time was chosen to allow time for the operator to evaluate and repair any discovered inoperability's. The completion time is appropriate given the ability to manually start the ECCS pumps and open the injection valves and to manually ensure the pump does not overheat.

Action F becomes necessary if the required action and associated completion time of Conditions C, D, or E are not met. If they are not met, then the associated ECCS injection/spray subsystem may be incapable of performing the intended function, and the ECCS subsystem must be declared inoperable immediately.

These Actions direct the licensee to take appropriate actions as necessary and enter into the Conditions referenced in Table 3.3.5.2-1. The NRC staff has determined that these actions satisfy the requirements of 10 CFR 50.36(c)(2)(i) by providing remedial action permitted by the TSs until the LCO can be met. Therefore, NRC staff has concluded that there is reasonable assurance that the licensee will take appropriate actions during an unexpected drain event to either prevent or to mitigate RPV water level being lowered to the TAF and, therefore, the proposed actions are acceptable.

3.2.3 Staff Evaluation of Proposed TS 3.3.5.2 Surveillances

The proposed new TS 3.3.5.2 SRs include Channel Checks, Channel Functional Tests, and Logic System Functional Tests numbered SR 3.3.5.2.1, SR 3.3.5.2.2, and SR 3.3.5.2.3, respectively. The NRC staff found that these tests are sufficient because they will ensure that 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 found that the proposed SRs of LCO 3.3.5.2 are acceptable and concludes that these SRs satisfy 10 CFR 50.36(c)(3) by providing specific SRs relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained.

Surveillance Requirement 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. Performance of the Channel Check ensures that a gross failure of instrumentation has not occurred. A Channel Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other

channels. A Channel Check is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. A Channel Check guarantees that undetected outright channel failure is limited; thus, it is key to verifying the instrumentation continues to operate properly between each Channel Functional Test. The frequency of SR 3.3.5.2.1 is in accordance with the Surveillance Frequency Control Program (SFCP), which is consistent with the existing requirements and supports operating shift situational awareness.

Channel Checks related to other functions are identified as Variation 3 in Section 3.5.3 of this SE.

Surveillance Requirement 3.3.5.2.2 would require a Channel Functional Test and applies to all functions in TS Table 3.3.5.2-1 except manual initiation. A Channel Functional Test is performed on each required channel to ensure that the entire channel will perform the intended function. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This is acceptable because all of the other required contacts of the relay are verified by other technical specifications and non-technical specifications tests. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The frequency of SR 3.3.5.2.1 is in accordance with the SFCP.

Surveillance Requirement 3.3.5.2.3 would require a Logic System Functional Test. The test is only applied to the manual initiation logic for LPCI/LPCS and demonstrates the operability of the required initiation logic for a specific channel. The frequency is in accordance with the SFCP. The LPCI/LPCS subsystem functional manual initiation signal testing performed in proposed SR 3.5.2.8 overlaps this surveillance to ensure complete testing of the safety function.

Revision 2 of TSTF-542 did 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. A draining event in Mode 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 function is to allow ECCS injection/spray manual initiation or automatically isolate a penetration flow path, but no specific RPV water level is assumed for those actions. Therefore, the Mode 3 allowable value 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 TSs 3.3.5.1 and 3.3.6.1 continue to require the functions to be calibrated on an established interval. The NRC staff has determined 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 ECCS Response Time (SR 3.5.1.8) and Isolation System Response Time (SR 3.3.6.1.7) testing ensures that the individual channel response times are less than or equal to the maximum values assumed in the accident analysis. Proposed new TS 3.3.5.2 does not include SRs to participate in any ECCS Response Time testing and Isolation System Response Time testing. This is acceptable because the purpose of these tests are to ensure that the individual channel response times are less than or equal to the maximum values assumed in the accident analysis, but a draining event in Modes 4 or 5 is not an analyzed accident and there are alternate manual methods for achieving the safety function. A potential draining event in Modes 4 and 5 is a slower event than a LOCA. More significant protective actions are required as the calculated DRAIN TIME decreases.

Based on the above, the NRC staff concludes that the proposed SRs of LCO 3.3.5.2 satisfy 10 CFR 50.36(c)(3) by providing the specific SRs relating to test, calibration, or inspection to assure that the necessary operability of systems and components is maintained and are, therefore, acceptable.

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

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

Proposed TS Table 3.3.5.2-1 specifies the instrumentation that shall be operable for each function in the table for Modes 4 and 5 (or other specified conditions), the required number of channels per function, conditions referenced from Required Action A.1, SRs for the functions, the allowable values, and footnotes concerning items of the table.

The NRC staff finds this table acceptable because it sufficiently discusses the purpose of the functions, the applicability, the number of required channels, the references to the Condition to be entered by letter (e.g., A, B, C, D) if the function is inoperable, the applicable SRs, the selection of the allowable value, and justification of differences between the existing and proposed TS functions. This RPV WIC Instrumentation set is acceptable, because it is adequate to ensure that the instrument channels respond 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.

Each of the ECCS injection/spray 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 (gpm). 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 1 hour), there is sufficient time for the reactor operators to take 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 ECCS to respond to an unexpected draining event. The NRC staff found this is acceptable because a draining event is a slow evolution when compared to a design basis LOCA assumed to occur at a significant power level.

3.2.4.1 Staff Evaluation of Proposed Table 3.3.5.2-1 Functions

For the TS Table 3.3.5.2-1, Functions 1.a (LPCS and LPCI-A) and 2.a, (LPCI B and C), Reactor Vessel Pressure - Low (Injection Permissive), the signals are used as 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 almost certain during Modes 4 and 5 that the reactor vessel pressure will be below the ECCS maximum design pressure, the Reactor Vessel Pressure - Low signals are assumed to be operable and capable of permitting initiation of the ECCS. The Reactor Vessel Pressure - Low signals are initiated from four pressure switches that sense the reactor dome pressure (one pressure switch for each low pressure

ECCS injection valve). The allowable value is low enough to prevent over pressurizing the equipment in the low pressure ECCS. Three channels of the Reactor Vessel Pressure - Low Function (one per valve) are only required to be operable in Modes 4 and 5 when ECCS Manual Initiation is required to be operable, since these channels support the manual initiation function. In addition, the channels are only required when the associated ECCS subsystem is required to be operable by LCO 3.5.2. The proposed allowable value is ≤ 492 pounds per square inch gauge (psig), with one per valve required channels per function, as it is currently in Columbia TS Table 3.3.5.1-1. The proposed allowable value is revised to eliminate the low pressure limit and to retain the high pressure limit.

For the TS Table 3.3.5.2-1, Functions 1.b and 1.c (LPCS and LPCI - A), and 2.b (LPCI - B and C), LPCI and LPCS Pump Discharge Flow - Low (Minimum Flow), these 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 fully 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 indicating switch per ECCS pump is used to detect the associated subsystems' flow rates. The logic is arranged such that each indicating switch 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 LPCI minimum flow valves are time delayed such that the valves will not open for 8 seconds after the switches detect low flow. The time delay is provided to limit reactor vessel inventory loss during the startup of the RHR shutdown cooling mode (for RHR A and RHR B). The Pump Discharge Flow - Low Allowable Values are high enough to ensure that the pump flow rate is sufficient to protect the pump, yet low enough to ensure that the closure of the minimum flow valve is initiated to allow full flow into the core. One channel of the Pump Discharge Flow - Low Function is required to be operable in Modes 4 and 5 when the associated LPCS or LPCI pump is required to be operable by LCO 3.5.2 to ensure the pumps are capable of injecting into the Reactor Pressure Vessel when manually initiated.

The proposed allowable values for Functions 1.b, 1.c, and 2.b are as follows (relocated from Columbia existing TS Table 3.3.5.1-1):

Function 1.b	LPCS	≥ 668 gpm and ≤ 1067 gpm
Functions 1.c and 2.b	LPCI A/B/C	≥ 605 gpm and ≤ 984 gpm

For the TS Table 3.3.5.2-1, Functions 1.d and 2.c, LPCS/LPCI Manual Initiation, the Manual Initiation switch and push button channels introduce signals into the appropriate ECCS logic to provide manual initiation capability and are redundant to the automatic protective instrumentation. There is one switch and push button (with two channels per switch and push button) for each of the two Divisions of low pressure ECCS (i.e., Division 1 ECCS, LPCS and LPCI A; Division 2 ECCS, LPCI B and LPCI C). The only manual initiation function required to be operable is that associated with the ECCS subsystem required to be operable by LCO 3.5.2. There is no allowable value for this function since the channels are mechanically actuated based solely on the position of the push buttons.

For the TS Table 3.3.5.2-1, Function 3.a, HPCS System, Condensate Storage Tank Level – Low, the low level signal in the CST indicates the unavailability of an adequate supply of makeup water from this normal source. Normally the suction valves between HPCS and the CST are open and water for HPCS injection would be taken from the CST. However, if the water level in the CST falls below a preselected level, first the suppression pool suction valve automatically opens, and then the CST suction valve automatically closes. This prevents losing

suction to the HPCS pump and ensures that an adequate supply of makeup water is available. Condensate Storage Tank Level - Low signals are initiated from two level switches mounted on a Seismic Category I standpipe in the reactor building (the two switches mounted on the CST cannot be credited since they are not Seismic I). Only one of the two switches is required to be operable in Modes 4 and 5. The Condensate Storage Tank Level - Low Function Allowable Value is high enough to ensure adequate pump suction head while water is being taken from the CST. The low water level limit in the CST is based on vortexing and potential air ingestion by the pump. One channel of the Condensate Storage Tank Level - Low Function is only required to be operable when HPCS is required to be operable to fulfill the requirements of LCO 3.5.2 and HPCS is aligned to the CST.

The existing allowable value for Function 3.a is ≥ 448 feet 1-inch elevation and the existing required channels per function is two. These values were previously found in Columbia TS Table 3.3.5.1-1. The proposed allowable value remains at ≥ 448 feet 1-inch elevation and the proposed required channels per function is changed to one as stated above.

For the TS Table 3.3.5.2-1, Functions 3.b, HPCS System, HPCS System Flow Rate – Low (Minimum Flow), minimum flow instrumentation is provided to protect the HPCS pump from overheating when the pump is operating and the associated injection valve is not fully 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 switch is used to detect the HPCS System's flow rate. The logic is arranged such that the flow switch causes the 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 HPCS System Flow Rate - Low is high enough to ensure that pump flow rate is sufficient to protect the pump, yet low enough to ensure that the closure of the minimum flow valve is initiated to allow full flow into the core. One channel of HPCS System Flow Rate - Low is required to be operable when HPCS is required to be operable by LCO 3.5.2 in Modes 4 and 5.

The existing allowable value for Function 3.b is between ≥ 1200 gpm and ≤ 1512 gpm and the existing required channels per function is one and was previously found in Columbia TS Table 3.3.5.1-1. The proposed allowable value remains between ≥ 1200 gpm and ≤ 1512 gpm and the proposed required channels per function remains at one.

For TS Table 3.3.5.2-1, Function 4.a, RHR SDC System Isolation, Reactor Vessel Water Level - Low, Level 3, 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 two in one trip system. The condition that the RHR system integrity be maintained is a concept related to OPDRVs, so it would not be carried over into Columbia TS 3.3.5.2 for RPV Water Inventory Control Instrumentation. Reactor Vessel Water Level - Low Level signals are initiated from differential pressure switches 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. While four channels (two channels per trip system) of the Reactor Vessel Water Level - Low, Level 3 Function are available, only two channels (all in the same trip system) are required to be operable. The Reactor Vessel Water Level - Low, Level 3 Allowable Value was chosen to be the same as the Primary Containment Isolation Instrumentation Reactor Vessel Water Level - Low, Allowable Value from TS Table 3.3.6.1-1 (Function 5.d), which is ≥ 9.5 inches since the capability to cool the fuel may be threatened.

For TS Table 3.3.5.2-1, Function 5.a, RWCU System Isolation, Reactor Vessel Water Level - Low, Level 2, 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 instrument channels is two in one trip system. Reactor Vessel Water Level - Low Low signals are initiated from differential pressure transmitters with trip units 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. While four channels (two channels per trip system) of the Reactor Vessel Water Level - Low, Level 2 Function are available, only two channels (all in the same trip system) are required to be operable. This proposed change is a new requirement in Modes 4 and 5 for the RWCU system. However, the instrumentation function is the same as TS Table 3.3.6.1, Function 4.j, which contains the requirements for Modes 1, 2, and 3, with the same allowable value of ≥ -58 inches.

The NRC staff finds that the proposed new LCO 3.3.5.2 correctly specifies the lowest functional capability or performance levels of equipment required for safe operation of the facility. There is reasonable assurance that the required actions to be taken when the LCO is not met are adequate to protect the health and safety of the public. This meets the requirements of 10 CFR 50.36(c)(2)(i) and, therefore, the staff has determined that the licensee's proposed changes to LCO 3.3.5.2 are acceptable.

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 new TS 3.5.2.

The proposed LCO 3.5.2 would state, in part,

> One ECCS injection/spray subsystem shall be OPERABLE.

One ECCS injection/spray subsystem is defined as either one of the three LPCI subsystems (LPCI A, LPCI B, or LPCI C), one LPCS system, or one HPCS system. The LPCI subsystem and the LPCS system consist of one motor-driven pump, piping, and valves to transfer water from the suppression pool to the RPV. The HPCS system consists of one motor-driven pump, piping, and valves to transfer water from the suppression pool or CST to the RPV.

The ECCS pumps are high-capacity pumps, with flow rates of thousands of 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 Columbia TS change as 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 Columbia TS 3.4.10, "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." These Columbia decay heat removal requirements are similar to the STSs and can be found in NUREG-1434, TS 3.4.10, "Residual Heat Removal (RHR) Shutdown Cooling System - Cold Shutdown," TS 3.9.7, "Reactor Pressure Vessel (RPV) Water Level - New Fuel or Control Rods," 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 provide reasonable assurance that the lowest functional capability required for safe operation is maintained and the safety limit is protected.

The proposed TS 3.5.2, "Reactor Pressure Vessel (RPV) Water Inventory Control," LCO contains two parts. The first part states that "DRAIN TIME of RPV water inventory to the Top of Active Fuel (TAF) shall be ≥ 36 hours," and the second part states, "One 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 would state:

> 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 proposed addition of this Note and the proposed deletion of a similar Note from existing SR 3.5.2.4 is evaluated in Section 3.5.10 of this SE (Variation 10).

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

The current TS LCO states that "Two ECCS injection/spray subsystems shall be OPERABLE," whereas the proposed LCO 3.5.2 states that only "One ECCS injection/spray subsystem shall be OPERABLE." This change is reflected in Condition A. The change from two ECCS injection/spray subsystems to one ECCS injection/spray subsystem is because this redundancy is not required. With one ECCS injection/spray subsystem and nonsafety-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 TAF.

The proposed Modes 4 and 5 applicability of TS 3.5.2 is appropriate given that the TS requirements on ECCS in Modes 1, 2, and 3 will be unaffected.

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 (Required Action C.1) verify the secondary containment boundary is capable of being established in less than the DRAIN TIME, and (Required Action C.2) verify each secondary containment penetration flow path is capable of being isolated less than the DRAIN TIME, and (Required Action C.3) verify one standby gas treatment subsystem is capable of being placed in operation in less than the DRAIN TIME all 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 < 8 hours to (Required Action D.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, (Required Action D.2) immediately initiate action to establish secondary containment boundary, (Required Action D.3) immediately initiate action to isolate each secondary containment penetration flow path or verify it can be manually isolated from the control room, and (Required Action D.4) immediately initiate action to verify required standby gas treatment subsystem(s) are 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 Columbia 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 of the requirement for the ability to 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 Columbia TS. The proposed Condition E is acceptable, as 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 evaluated the proposed changes to TS 3.5.2 and finds them acceptable based on the actions taken to mitigate the water level reaching TAF with the water sources available, and maintaining DRAIN TIME ≥ 36 hours. LCO 3.5.2 correctly specifies the lowest functional capability or performance levels of equipment required for safe operation of the facility. There is 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 and, therefore, they are acceptable.

3.3.1 Staff Evaluation of Proposed TS 3.5.2 Surveillance Requirements

The proposed TS 3.5.2 SRs include verification of DRAIN TIME, verification of water levels/volumes that support ECCS subsystems, verification of water filled pipes to preclude water hammer events, verification of correct valves positions for the required ECCS injection/spray subsystem, operation of the ECCS injection/spray systems ≥ 10 minutes, verification of valves credited for automatic isolation actuated to the isolation position, and verification that the required ECCS injection/spray subsystem can be manually initiated (LPCS/LPCI) or manually operated (HPCS). Each of the eight 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 SR would verify that the LCO for DRAIN TIME is met. Numerous indications of changes in RPV level are available to the operator. The period of 36 hours is considered reasonable to identify and initiate action to mitigate draining of

reactor coolant (normally three 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 (≥ 18 feet 6 inches) for a required LPCS/LPCI subsystem is required to be verified to ensure pump net positive suction head and vortex prevention is available for the LPCS/LPCI subsystem required to be operable by the LCO. Indications are available either locally or in the control room regarding suppression pool water level. This SR would be required to be performed in accordance with the SFCP.

SR 3.5.2.3 (previously SR 3.5.2.2): The suppression pool water level (≥ 18 feet 6 inches) or condensate storage tank level (≥ 16.5 feet in a single CST or ≥ 10.5 feet in each CSTs) for a required HPCS system is required to be verified to ensure pump net positive suction head and vortex prevention is available for the HPCS system required to be operable by the LCO. Indications are available either locally or in the control room regarding suppression pool water level and condensate storage tank level. This SR 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 ECCS injection/spray subsystem piping is sufficiently filled with water would be retained from the existing TS 3.5.2. The proposed change would update the SR to reflect the 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 existing 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 of water ensures that the ECCS injection/spray subsystem will perform properly. This will also prevent a water hammer following an ECCS initiation signal. One acceptable method of ensuring that the lines are full is to vent at the high points. This SR would be required to be performed in accordance with the SFCP.

SR 3.5.2.5 (previously SR 3.5.2.4): The SR to verify the correct alignment for each manual, power operated, and automatic valves in the required ECCS injection/spray subsystem flow path would be retained from the existing TS 3.5.2. Similar to the change discussed above for proposed SR 3.5.2.4, changes to SR 3.5.2.5 would clarify a proposed requirement for TS LCO 3.5.2. The proposed SR wording for SR 3.5.2.5 is, "Verify for the required ECCS injection/spray subsystem, each manual, power operated..." would replace existing SR 3.5.2.4, "Verify each required ECCS injection/spray subsystem manual, power operated ..." SR 3.5.2.5 would provide assurance that the proper flow path will be available for ECCS operation to support TS 3.5.2. This SR does not apply to valves that are locked, sealed, or otherwise secured in position since these valves were 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 non-accident 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. Existing SR 3.5.2.4 has a note the states that it is "[n]ot required to be met for system vent flow paths opened under administrative controls" and this note is incorporated into new SR 3.5.2.5. This SR would be required to be performed in accordance with the SFCP.

SR 3.5.2.6: The required ECCS injection/spray subsystem would be required to be operated for at least 10 minutes in accordance with the SFCP. This would demonstrate that the subsystem is available to mitigate a draining event. Testing the ECCS injection/spray subsystem must be

done in such a way to avoid overfilling the refueling cavity. Thus, this SR is modified by a Note that states that "[I]njection into the vessel is not required." The minimum operating time of 10 minutes was based on engineering judgement. See also Variation 6 (Section 3.5.6 of this SE).

SR 3.5.2.7: Verification 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 would be required to prevent RPV water inventory from dropping below the TAF should an unexpected draining event occur. This SR would be required to be performed in accordance with the SFCP.

SR 3.5.2.8 (previously SR 3.5.2.6): This SR would state, "Verify the required LPCI or LPCS subsystem actuates on a manual initiation signal or the required HPCS subsystem can be manually operated." The SR verifies that a manual initiation signal will cause the required LPCI subsystem or LPCS system to start and operate as designed, including pump startup and actuation of all automatic valves to their required positions. The HPCS system is verified to start manually from a standby configuration, and includes the ability to override the RPV Level 8 injection valves isolation. Vessel injection/spray may be excluded from the SR, per the new Note. This SR 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 concluded they are appropriate for ensuring the operability of the equipment and instrumentation specified in LCO 3.5.2. The staff concluded 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.

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

Limiting Condition for Operation 3.3.5.1 currently states that "[t]he ECCS instrumentation for each Function in Table 3.3.5.1-1 shall be OPERABLE," with the applicability as stated in the table. 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 injection/spray subsystem(s) are required to be operable. Conforming changes were proposed for the Actions table of LCO 3.3.5.1 as well.

As discussed above in Section 2.2.2.1, the licensee proposed to delete the following Modes 4 and 5, Table 3.3.5.1-1, function requirements:

FUNCTION	FUNCTIONS DELETED	FUNCTION RELOCATED TO TABLE 3.3.5.2-1
1. Low Pressure Coolant Injection - A (LPCI) and Low Pressure Core Spray (LPCS) Subsystems;		
a. Reactor Vessel Water Level - Low Low Low, Level 1	Yes	
c. LPCS Pump Start - LOCA Time Delay Relay	Yes	
d. LPCI Pump A Start - LOCA Time Delay Relay	Yes	

e. LPCI Pump A Start - LOCA/LOOP Time Delay Relay	Yes	
f. Reactor Vessel Pressure - Low (Injection Permissive)	No	Function 1.a
g. LPCS Pump Discharge Flow - Low (Minimum Flow)	No	Function 1.b
h. LPCI Pump A Discharge Flow - Low (Minimum Flow)	No	Function 1.c
i. Manual Initiation	No	Function 1.d
2. LPCI B and LPCI C Subsystems;		
a. Reactor Vessel Water Level – Low Low Low, Level 1	Yes	
c. LPCI Pump B Start – LOCA Time Delay Relay	Yes	
d. LPCI Pump C Start – LOCA Time Delay Relay	Yes	
e. LPCI Pump B Start – LOCA/LOOP Time Delay Relay	Yes	
f. Reactor Vessel Pressure – Low (Injection Permissive)	No	Function 2.a
g. LPCI Pumps B & C Discharge Flow – Low (Minimum Flow)	No	Function 2.b
h. Manual Initiation	No	Function 2.c
3. High Pressure Core Spray (HPCS) System;		
a. Reactor Vessel Water Level - Low Low, Level 2	Yes	
c. Reactor Vessel Water Level - High, Level 8	Yes	
d. Condensate Storage Tank Level - Low	No	Function 3.a
f. HPCS System Flow Rate - Low (Minimum Flow)	No	Function 3.b
g. Manual Initiation	Yes	

As shown in the table above, eleven functions above would be deleted completely to support the consolidation of RPV WIC instrumentation requirements into proposed TS 3.3.5.2. The other nine functions would be moved to proposed TS Table 3.3.5.2-1 as discussed in Section 3.2.4.1 of this SE.

The Columbia 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 TS Table 3.3.5.1-1, Functions 1.a, 2.a, and 3.a, to be acceptable because manual ECCS alignment is preferred over automatic initiation during Modes 4 and 5, and the operator would be able to use other, more appropriately sized pumps if needed to mitigate a draining event. In addition, the NRC staff finds the deletion of TS Table 3.3.5.1-1, Functions 1.e and 2.e to be acceptable for the LPCI A and B LOCA/LOOP (loss of offsite power) pump start time delay relays. The purpose of these time delays is to stagger the automatic start of LPCI A/B pumps thus limiting the starting transients on the emergency buses. The staggered starting of ECCS pumps is unnecessary for manual ECCS operation because unlike automatic starts, which initiate all of the ECCS pumps to start requiring the delay logic, the operator will control which ECCS pumps to start, one at a time as needed for water inventory control.

The deletion of ECCS LOCA time delay relays (TS Table 3.3.5.1-1, Functions 1.c, 1.d, 2.c, and 2.d) are evaluated in Variation 1 in Section 3.5.1 of this SE. The deletion of the HPCS manual initiations (Function 3.g) and HPCS vessel water high Level 8 interlock (Function 3.c) are evaluated in Variation 4 in Section 3.5.4 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 NRC staff's SE for TSTF-542. The licensee stated in the application that these variations do not affect the applicability of TSTF-542, Revision 2, or the NRC staff's SE to the proposed license amendment. The NRC staff evaluated each variation below.

3.5.1 Variation 1, TS Table 3.3.5.1-1, LPCS/LPCI LOCA Time Delay Relays

The ECCS Instrumentation for Columbia includes additional Function 1.c, "LPCS Pump Start LOCA Time Delay Relay," Function 1.d, "LPCI Pump A Start - LOCA Time Delay Relay," Function 2.c, "LPCI Pump B Start - LOCA Time Delay Relay," and Function 2.d, "LPCI Pump C Start – LOCA Time Delay Relay."

The NRC finds that the LPCI/LPCS LOCA pump start time delay relay logic is unnecessary given the new requirements set forth in TSTF-542, Revision 2. The purpose of the time delay relays is to stagger the start of the ECCS pumps, thus limiting the starting transients on the 4.16 kV emergency buses. This time delay is unnecessary for manual operation where operators will ensure overloading does not occur; therefore, this function can be removed from the TS and the NRC staff finds Variation 1 is acceptable.

3.5.2 Variation 2, TS Table 3.3.5.1-1, Function 2.f, Reactor Vessel Pressure - Low (Injection Permissive)

The Columbia ECCS Instrumentation Function 2.f, "Reactor Vessel Pressure - Low (Injection Permissive)," is equivalent to Function 2.d, "Reactor Steam Dome Pressure - Low (Injection Permissive)," in NUREG-1434. As noted on page 20 of TSTF-542, Revision 2, NUREG-1434 does not include the Mode 4 and 5 applicability of this function, which was an apparent oversight in the development of the NUREG. However, the Columbia TS does contain the Mode 4 and 5 applicability for this function. Consistent with the intent of TSTF-542, Revision 2, the Mode 4 and 5 requirements are deleted from TS 3.3.5.1 (see also discussion for the new TS 3.3.5.2) for this function.

The NRC staff acknowledges the oversight in the development of the NUREG related to STS Table 3.3.5.1-1, Function 2.d (which is equivalent to Columbia TS Table 3.3.5.1-1, Function 2.f). The NRC staff finds that the difference between the instrumentation noun names (dome pressure verses vessel pressure), which are part of the existing license, is an acceptable variation and does not change the conclusion that TSTF-542 is applicable to the Columbia TSs. Columbia has included this Reactor Vessel Pressure - Low (Injection Permissive) Function into proposed Table 3.3.5.2-1, Function 2.a, consistent with the changes required by TSTF-542, Revision 2; therefore, the NRC staff finds Variation 2 is acceptable.

3.5.3 Variation 3, TS Table 3.3.5.2-1, LPCS/LPCI, HPCS, and RWCU Channel Checks

Columbia does not have the capability to perform channel checks for the following eight functions in proposed Table 3.3.5.3-1:

LPCI A and LPCS Subsystems:

Function 1.a, "Reactor Vessel Pressure - Low (Injection Permissive)"

Function 1.b, "LPCS Pump Discharge Flow - Low (Minimum Flow)"
Function 1.c, "LPCI Pump A Discharge Flow - Low (Minimum Flow)"

LPCI B and LPCI C Subsystems:

Function 2.a, "Reactor Vessel Pressure - Low (Injection Permissive)"
Function 2.b, "LPCI Pumps B & C Discharge Flow - Low (Minimum Flow)"

HPCS System:

Function 3.a, "Condensate Storage Tank Level – Low"
Function 3.b, "HPCS System Flow Rate - Low (Minimum Flow)"

RWCU System:

Function 5, "Reactor Vessel Water Level - Low Low, Level 2"

The NRC staff has determined that the above instrument functions do not have existing channel checks (existing TS Table 3.3.5.1-1, SR 3.3.5.1.1) and no future channel checks were proposed for the instruments being relocated to new TS Table 3.3.5.2-1 functions. Since the current plant design does not include channel checks for these functions the licensee will retain its current licensing basis for these instruments. Therefore, the NRC staff finds Variation 3 is acceptable.

3.5.4 Variation 4, Deletion of HPCS Functions; Manual Initiation; and RPV Water Level High, Level 8

TS Table 3.3.5.2-1, Function 3.a, "Reactor Vessel Water Level - High, Level 8," and Function 3.e, "Manual initiation," that appear in TSTF-542, Revision 2, are not included in the proposed Technical Specifications. This corrects an error in TSTF-542 that affects BWR/5 and BWR/6 ECCS instrumentation requirements. Columbia is a BWR/5 plant.

The purpose of the manual initiation function is to allow manual actuation of the ECCS subsystem required by TS 3.5.2 to mitigate a draining event. The Reactor Vessel Water Level - High, Level 8 signal prevents overfilling of the reactor vessel into the main steam lines by closing the HPCS injection valves when the water level is above the Level 8 setpoint. Therefore, if HPCS is the required ECCS subsystem and the water level is above Level 8, manually actuating Function 3.e, HPCS Manual Initiation will not inject inventory into the reactor vessel. If the Level 8 function is retained in Table 3.3.5.2-1, the function would need to be rendered inoperable in order to inject water when above the Level 8 water level. This would not be consistent with including the function in Table 3.3.5.2-1.

Columbia has the capability to manually start the HPCS pump and to open the HPCS injection valve if needed, bypassing Functions 3.a and 3.e. If it is desired to inject water into the reactor pressure vessel using HPCS, the reactor operator can follow procedural steps to take manual control of the pump and injection valve to add inventory. If the water level is above Level 8, then manual override of the Level 8 function can be performed to allow the HPCS injection valve to be opened. These actions can be performed from the control room and can be accomplished well within the 1-hour minimum DRAIN TIME limit specified in TS 3.5.2, Condition E. Consequently, the Function 3.a and 3.e instrumentation are not needed to actuate the HPCS subsystem components to mitigate a draining event.

In addition, the TSTF-542 markup of NUREG-1434 contains LCO 3.3.5.2 Actions, Condition E, which is only associated with Table 3.3.5.2-1, Function 3.a, "Reactor Vessel Water Level -High, Level 8." Since this function is being deleted, Condition E is also being deleted and subsequent conditions are being relettered for the proposed new LCO 3.3.5.2.

Table 3.3.5.2-1, Functions 3.a, and 3.e, as described in TSTF-542, Revision 2, are not needed to actuate the HPCS subsystem components to mitigate a draining event, and are not included in the proposed Table 3.3.5.2-1 for Columbia. If it is desired to inject water into the reactor pressure vessel using HPCS, the reactor operator can take manual control of the pump and injection valve to add inventory. In addition, if the water level is above the High Water Level 8, then manual override of this function would need to be performed to allow the HPCS injection valve to be opened. The manual initiation functions for the ECCS low pressure subsystems are maintained. Therefore, the NRC staff finds the deletions of the Manual Initiation and RPV Water Level 8 Functions for HPCS are acceptable.

In addition, the NRC staff finds that TS 3.3.5.2, Condition E and associated Required Actions E.1, and E.2 (Reference 4), which is associated with the HPCS Level 8 instrumentation, is no longer needed because all functions in Table 3.3.5.2-1 that reference this condition have been removed. Therefore, the NRC staff finds Variation 4 is acceptable.

3.5.5 Variation 5, TS Table 3.3.7.1-1, Reactor Building Vent Exhaust Plenum

Columbia TS Table 3.3.7.1-1 contains Function 3, "Reactor Building Vent Exhaust Plenum Radiation - High." This function will isolate the control room emergency filtration system on high secondary containment exhaust radiation. This function is modified to remove the applicability during operations with a potential for draining the reactor vessel (Footnote (a)). NUREG-1434 does not contain this function.

The NRC staff finds the removal of the Columbia TS Table 3.3.7.1-1, Function 3, "Reactor Building Vent Exhaust Plenum Radiation - High" is consistent with the guidance in TSTF-542, Revision 2 for plants to remove references to OPDRVs as needed in their current licensing basis; therefore, the NRC staff finds Variation 5 is acceptable.

3.5.6 Variation 6, ECCS Injection/Spray Subsystem through the Recirculation Line

In TSTF-542, the NUREG-1434 markup for SR 3.5.2.6 states: "Operate the required ECCS injection/spray subsystem through the recirculation line for ≥ 10 minutes." The licensee proposes to modify the TSTF-542 markups of SR 3.5.2.6 by deleting "through the recirculation line" and adding a note that states: "Injection into the vessel is not required." At Columbia, only the LPCI A and B subsystems can inject through the reactor recirculation lines, which would preclude use of other ECCS subsystems to meet LCO 3.5.2.

Section 3.2.4.5 in TSTF-542, Revision 2, states, in part:

> The proposed test will ensure that the required ECCS injection/spray subsystem is capable to [sic] being manually started [sic] and will operate to mitigate an unexpected draining event. Testing the ECCS injection/spray subsystem through the recirculation line is necessary to avoid overfilling the refueling cavity.

At Columbia, the ECCS subsystems are equipped with test lines and minimum flow lines that discharge to the suppression pool. When HPCS, LPCS, or LPCI C is the credited ECCS injection/spray subsystem, this SR will be performed by discharging to the suppression pool. When LPCI A or B is the credited subsystem, this SR will be performed by either discharging through the recirculation line to the vessel or through the minimum flow line or test line to the suppression pool. This test continues to meet the intent of TSTF-542, Revision 2, to ensure the credited subsystem manually starts and can operate to mitigate a draining event. Note that the proposed SR 3.5.2.8 continues to test all active components including the vessel injection valves to ensure proper operation. This variation is acceptable and meets the intent of TSTF-542, Revision 2.

The NRC staff has determined that the deletion of the phrase "through the recirculation line" is acceptable since the intent of this SR was to verify pump LPCI, LPCS, and HPCS flow is available to mitigate a drain down event. For example, flow verification can be perform through the recirculation line, test line, and/or minimum flow lines to the suppression loop to avoid overfilling the reactor cavity. Therefore, the NRC staff finds Variation 6 is acceptable.

3.5.7 Variation 7, TS 3.6.1.3 PCIVs Modes for Condition E

Applicability of Columbia TS 3.6.1.3, "Primary Containment Isolation Valves (PCIVs)," is modified to only apply to Modes 1, 2, and 3. Columbia TS Condition E contains the phrase "in Modes 1, 2, or 3." This phrase is proposed to be deleted as it is no longer needed.

The NRC finds that for TS 3.6.1.3, Condition E, the reference to "Mode 1, 2, and 3," can be deleted since these are unnecessary given the new requirements set forth in TSTF-542, Revision 2, for Modes 4 and 5. This variation is consistent with the treatment of other primary containment isolation instruments as discussed in Section 3.4.1.2, "TS 3.3.6.1A and 3.3.6.1b, Primary Containment Isolation Instrumentation," and in Section 3.4.2, "Other Proposed Changes - Containment, Containment Isolation Valves, and Standby Gas Treatment System Requirements," of the justification for TSTF-542, Revision 2. The applicability for TS 3.6.1.3 is revised with the deletion of "When associated instrumentation is required to be operable per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation;" therefore, the NRC finds Variation 7 is acceptable.

3.5.8 Variation 8, Removal of 'Mode 1, 2 and 3' from Secondary Containment, SCIVs, SGT, CREF, and Control Room A/C System Technical Specifications

In NUREG-1434, the applicability for the above listed TSs includes "[During movement of [recently] irradiated fuel assemblies in the [primary or secondary containment]." The Columbia TS do not contain this applicability statement as it was removed by Amendment No. 199. The existing applicability for Columbia is during Modes 1, 2, and 3, and during OPDRVs. Consistent with TSTF-542, Revision 2, the licensee is proposing to delete "[d]uring operations with a potential for draining the reactor vessel (OPDRVs)" from the applicability. Thus, the remaining applicability is Modes 1, 2, and 3. The following conditions contain the phrase "in Mode 1, 2, or 3." This phrase is proposed to be deleted as it is no longer needed for the following TSs.

- TS 3.6.4.1 Condition A
- TS 3.6.4.2 Condition C
- TS 3.6.4.3 Conditions B and D

- TS 3.7.3 Conditions B, C, and E
- TS 3.7.4 Condition C

The NRC finds that for TS 3.6.4.1, TS 3.6.4.2, TS 3.6.4.3, TS 3.7.3, and TS 3.7.4, conditions that are referenced to "Mode 1, 2, and 3," can be deleted, since these are unnecessary given the new requirements set forth in TSTF-542, Revision 2, DRAIN TIME and RPV WIC for Mode 4 and 5. This variation is consistent with the treatment of containment as discussed in Section 3.4.2 and Section 3.4.3, of the justification for TSTF-542, Revision 2. The applicability for these five TSs is revised with the deletion of, "During operations with a potential for draining the reactor vessel (OPDRVs);" therefore, the NRC finds Variation 8 is acceptable.

3.5.9 Variation 9, Removal of 'Conditions from Secondary Containment, SCIVs, SGT, CREF, and Control Room A/C System Technical Specifications

Similarly, in NUREG-1434, a condition in the above listed TSs includes, "... inoperable during movement of [recently] irradiation fuel assemblies in the [primary or secondary containment] or during OPDRVs." The equivalent condition in the Columbia TS reads, "... inoperable during OPDRVs." Since "during OPDRVs" is deleted from the applicability, the following conditions are deleted in their entirety since they are no longer required. These changes are consistent with TSTF-542, Revision 2. This change also results in renumbering remaining conditions.

- TS 3.6.4.1 Condition C
- TS 3.6.4.2 Condition D
- TS 3.6.4.3 Condition C and E
- TS 3.7.3 Conditions D and F
- TS 3.7.4 Conditions D and E

The NRC finds that for TS 3.6.4.1, TS 3.6.4.2, TS 3.6.4.3, TS 3.7.3, and TS 3.7.4, conditions that are referenced to "OPDRV," can be deleted, since these are unnecessary given the new requirements set forth in TSTF-542, Revision 2, DRAIN TIME and RPV WIC for Modes 4 and 5. The applicability for these five TSs is revised with the deletion of, "During operations with a potential for draining the reactor vessel (OPDRVs);" therefore, the NRC finds Variation 9 is acceptable.

3.5.10 Variation 10, TS LCO 3.5.2, LPCI and Decay Heat Removal Note

In NUREG-1434, LCO 3.5.2 is modified by a Note regarding the Low Pressure Coolant Injection subsystem being considered operable during alignment and operation for decay heat removal. This Note is modified by TSTF-542 to change "one" to "a". In the Columbia TSs, this Note modifies SR 3.5.2.4 (rather than the LCO). The verbiage is the same between the Columbia TS and NUREG-1434. To maintain consistency with the presentation in TSTF-542, Revision 2, the SR 3.5.2.4 note will be deleted from the SR and moved to LCO 3.5.2 at the LCO level.

The NRC staff finds that the added Note to LCO 3.5.2 associated with the LPCI subsystem is appropriate and is consistent with TSTF-542, Revision 2, 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 3.5.2.4 which allows the LPCI

subsystem to be operable when aligned for decay heat removal; therefore, the NRC staff finds Variation 10 is acceptable.

3.6 Staff Evaluation of Proposed Deletion of Reference to OPDRVs

Section 2.2.4 of this SE lists the numerous OPDRV references proposed for deletion. The proposed changes would replace the existing specifications related to OPDRVs with revised specifications for RPV WIC. For example, the proposed changes would remove:

- Only one trip system required in MODES 4 and 5 with RHR SDC System integrity maintained.
- During operations with a potential for draining the reactor vessel.
- When associated instrumentation is required to be OPERABLE per LCO 3.3.6.1, "Primary Containment Isolation Instrumentation."
- Initiation action to suspend operations with a potential for draining the reactor vessel (OPDRVs).
- When associated subsystem(s) are required to be OPERABLE.
- When HPCS is OPERABLE for compliance with LCO 3.5.2, "ECCS - Shutdown" and aligned to the condensate storage tank while tank water level is not within the limits of SR 3.5.2.2.

The term OPDRVs 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 SRs, and deleting references to OPDRVs throughout the TS.

The existing Columbia TSs contain instrumentation requirements related to OPDRVs in four separate TS sections. 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, SGT system, control room emergency filtration system, control room A/C system, and electrical sources. Each of these systems' requirements during OPDRVs were proposed for consolidation into revised TS 3.5.2 for RPV WIC, based on the appropriate plant conditions and calculated DRAIN TIME.

The NRC staff determined that the deletion of OPDRV 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 water level is maintained above the TAF; therefore, the NRC staff determined that this change is acceptable.

3.7 Staff Evaluation of TS 3.10, Special Operations and TSTF-484

The current Columbia TS LCO 3.10.1, "Inservice Leak and Hydrostatic Testing Operation," allows performance of an inservice leak or hydrostatic test with the average reactor coolant temperature greater than 200 °F, while considering operational conditions to still be in Mode 4, provided certain secondary containment LCOs were met.

TSTF-484, Revision 0 "Use of TS 3.10.1 for Scram Time Testing Activities," revised LCO 3.10.1 to expand its scope to include operations where 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 No. 209, dated September 16, 2008, the NRC approved changes to Columbia TS LCO 3.10.1 in accordance with TSTF-484 (Reference 10). The NRC staff's SE for this amendment stated, in part, that "two low-pressure emergency core cooling systems (ECCS) injected/spray subsystems are required to be operable in Mode 4 by TS 3.5.2, ECCS-Shutdown." However, per the proposed new LCO 3.5.2, only one low pressure ECCS injection/spray subsystem would be required to be operable in Mode 4.

The NRC staff determined 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 3.10.1. When the licensee applies LCO 3.10.1 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 and more than is present during most of an outage. 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 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 nonsafety- 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 TAF.

After considering of the reasoning presented in this SE for TSTF-542, Revision 2 and the information in the SE enclosed with the NRC letter dated September 16, 2008, the NRC staff determined that LCOs 3.3.5.2 and 3.5.2 adopted as part of TSTF-542, Revision 2 are satisfactory and will, therefore, be acceptable even during application of LCO 3.10.1.

3.8 Technical Conclusion

Columbia TS Safety Limit 2.1.1.3 requires that "reactor vessel water level shall be greater than top of active fuel." Maintaining water level above TAF ensures that the fuel cladding fission product barrier is protected during shutdown conditions. The proposed changes to the

TSs evaluated within this SE establish new LCO 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 Mode 4 and 5 operations.

The reactor coolant system is at a low operating temperature (i.e., < 200 °F) and is depressurized during Modes 4 and 5 conditions. An event involving a loss of inventory while in the shutdown condition does not exceed the capacity of one ECCS injection/spray subsystem. The accidents that are postulated to occur during shutdown conditions (i.e., the fuel handling accident (Reference 11, Section 15.7.4 of the FSAR) and the postulated radioactive release due to liquid radwaste tanks failure (Reference 11, Section 15.7.3 of the FSAR)) do not involve a loss of inventory. Therefore, the equipment and instrumentation associated with the RPV WIC TSs do not provide detection or mitigation related to these design basis accidents.

The proposed TS LCO 3.5.2 contains requirements for operability of one ECCS injection/spray subsystem along with requirements to maintain a sufficiently long DRAIN TIME such that plant operators would have time to diagnose and mitigate an unplanned draining event. The NRC staff has determined 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 LCO requirements of 10 CFR 50.36(c)(2)(i).

Additionally, the revised TS LCOs 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), and are thereby acceptable.

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), 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 remove OPDRV references from the TS applicability description, conditions, required actions, and footnotes. The NRC staff reviewed the proposed changes and determined that deletion of OPDRV references, along with that 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 since 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, verified pumps provide adequate flow to support drain time and RPV injection, verification of automatic isolation, HPCS System can be

manually operated, and LPCS/LPCI subsystems actuates on a manual initiation signal. The NRC staff finds that the three SRs proposed for TS 3.3.5.2 are sufficient and adequate, because they ensure that the functions are capable of performing their specified safety functions in support of TS 3.5.2, 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), and are thereby acceptable.

The NRC staff evaluated the proposed Columbia changes against each of the unit applicable design requirements listed in Section 2.3.1 of this SE. The NRC staff finds that the proposed changes for Mode 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 design criteria in that the Columbia 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 license amendment request dated October 23, 2017 (Reference 1). The NRC staff concludes that the TS Bases changes provided describe the bases for the affected TSs and follow the "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors" (58 FR 39132; July 22, 1993).

Additionally, the proposed TS changes were reviewed for technical clarity and consistency with the existing Columbia requirements for customary terminology and formatting. The NRC staff found that the proposed changes were consistent with TSTF-542, Revision 2 (Reference 4) and Chapter 16 of NUREG-0800 (Reference 8).

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Washington State official was notified of the proposed issuance of the amendment on September 11, 2018. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20 and changes SRs. The NRC staff has determined that the amendment involves 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 amendment involves no significant hazards consideration, published in the *Federal Register* on January 16, 2018 (83 FR 2227), and there has been no public comment on such finding. Accordingly, the amendment meets 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 amendment.

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

7.0 REFERENCES

1 Schuetz, R. E., Energy Northwest, letter to U.S. Nuclear Regulatory Commission, "Columbia Generating Station, Docket No. 50-397, License Amendment Request to Revise Technical Specifications to Adopt TSTF-542, 'Reactor Pressure Vessel Water Inventory Control,'" dated October 23, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17296B380).

2 Hettel, W. G., Energy Northwest, letter to U.S. Nuclear Regulatory Commission, "Columbia Generating Station, Docket No. 50-397, Supplement to License Amendment Request to Revise Technical Specifications to Adopt TSTF-542, 'Reactor Pressure Vessel Water Inventory Control,'" dated November 15, 2017 (ADAMS Accession No. ML17320A314).

3 Schuetz, R. E., Energy Northwest, letter to U.S. Nuclear Regulatory Commission, "Columbia Generating Station, Docket No. 50-397, Response to Request for Additional Information for TSTF-542 License Amendment Request" dated June 27, 2018 (ADAMS Accession No. ML18178A662).

4 Technical Specifications Task Force letter to U.S. Nuclear Regulatory Commission, Response to NRC Request for Additional Information Regarding TSTF-542, Revision 1, 'Reactor Pressure Vessel Water Inventory Control' and Submittal of Revision 2," dated March 14, 2016 (ADAMS Accession No. ML16074A448).

5 Klein, Alexander, U.S. Nuclear Regulatory Commission, letter to Technical Specifications Task Force, "Final Safety Evaluation of Technical Specifications Task Force Traveler TSTF-542, Revision 2, 'Reactor Pressure Vessel Water Inventory Control' (TAC NO. MF3487), dated December 20, 2016 (ADAMS Accession No. ML16343B008).

6 U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, General Electric BWR/6 Plants," NUREG-1434, Revision 4.0, Volume 1, Specifications, dated April 2012 (ADAMS Accession No. ML12104A195).

7 U.S. Nuclear Regulatory Commission, "Standard Technical Specifications, General Electric BWR/6 Plants," NUREG-1434, Revision 4.0, Volume 2, Bases, dated April 2012 (ADAMS Accession No. ML12104A196).

8 U.S. Nuclear Regulatory Commission, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," NUREG-0800, Section 16, Revision 3, dated March 2010 (ADAMS Accession No. ML100351425).

9 Columbia Generating Station, Final Safety Analysis Report, Chapter 3, "Design Criteria – Structures, Components, Equipment, and Systems" (ADAMS Accession No. ML17355A662).

10. Lyon, C. F., U.S. Nuclear Regulatory Commission, letter to Mr. J. V. Parrish, Energy Northwest, "Columbia Generating Station - Issuance of Amendment Re: Adoption of TSTF-484, 'Use of TS 3.10.1 for Scram Time Testing Activities' (TAC No. MD8687)," dated September 16, 2008 (ADAMS Accession Nos. ML082380017 and ML082380018).

11. Columbia Generating Station, Final Safety Analysis Report, Chapter 15, "Accident Analyses" (ADAMS Accession No. ML17355A670).

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Date: October 30, 2018

SUBJECT: COLUMBIA GENERATING STATION - ISSUANCE OF AMENDMENT RE: REVISION TO TECHNICAL SPECIFICATIONS TO ADOPT TSTF-542, REVISION 2, "REACTOR PRESSURE VESSEL WATER INVENTORY CONTROL" (EPID L-2017-LLA-0361) DATED OCTOBER 30, 2018

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