Chapter 5: From Revision 1 to Revision 2 Change List

Item	Location	Description of Change
1	Figure 5.1-2	Deleted the change in Quality Group and Seismic Category classification at the inlet of the feedwater motor operated shutoff valves.
2	Figure 5.1-3	Modified the schematic as follows: • included the inline vessel • deleted the line size designations • added solenoid operator valve symbols to upper header vent line valves • changed lower header vent line valves from motor operator to solenoid operator • changed steam supply line valve from motor operator to nitrogen operator • added new solenoid operated valve in purge line • removed orifice from purge line • changed purge line valve from motor operator to solenoid operator • changed condensate return line valves from motor operator to nitrogen operator
3	Figure 5.1-4	Changed actuators of containment isolation valves in sample line from NO and AO to SO.
4	S5.2.2	In fourth paragraph, added the following as items (2) and (3), respectively, in accordance with response to RAI 5.2-6: "General Design Criterion 14, as it relates to the reactor coolant pressure boundary being designed, fabricated of, erected and tested so as to have an extremely low probability of abnormal leakage, rapidly propagating failure and of gross rupture." "General Design Criterion 30, as it relates to components, which are part of the reactor coolant pressure boundary, being designed, fabricated, erected and tested to the highest quality standards practical."
5	S5.2.2	In fifth paragraph, changed paragraph in accordance with response to RAI 5.2-8 to read as follows: "The ESBWR design meets the recommendations of the TMI action plan item II.D.1 in 10 CFR 50.34(f)(2)(x)

		regarding a test program and associated model development and testing to qualify reactor coolant system relief and safety valves for all fluid conditions expected under operating conditions, design basis transients and accidents. The ESBWR design also meets the recommendations of TMI action plan item II.D.3 in 10 CFR 50.34(f)(2)(xi) regarding SRV position indication by providing open and closed indication of each valve."
6	S5.2.2	Updated text in last paragraph as follows: Replaced "spring" with "mechanical lift". Deleted "spring-loaded". Changed last sentence to read as follows: "The valves are designed and constructed in accordance with ASME Code, Section III, NB 7510, Safety, Safety Relief, and Relief Valves, NB 7520, Pilot Operated Pressure Relief Valves, or NB 7540, Safety Valves or Pilot Operated Pressure Relief Valves with Auxiliary Actuating Devices."
7	S5.2.2.2.2	In first paragraph, updated text in accordance with response to RAI 5.2-11 as follows: First sentence, added "18" before "SRVs". Changed third sentence to read, "Ten SRVs are designated as ADS SRVs and each discharges through a line routed to a quencher in the suppression pool." Fourth sentence, added "are designated as Non-ADS SRVs and" after "SRVs". Seventh sentence, replaced "These" with "The Non-ADS". Eighth sentence, changed from "These" to "The" and changed from "valves" to "SRVs".
8	S5.2.2.2.2	Moved fourth paragraph to become the third sentence of third paragraph and added the following new text at beginning of the moved paragraph: "In response to an event that activates the SRVs,"
9	S5.2.2.2.2	In the fifth paragraph, changed the first two sentences in accordance with response to RAI 5.2-11 to read as follows: "All eighteen of the SRVs are opened by the safety (steam pressure) mode of operation. These SRVs open by steam pressure when the main or pilot disk opens quickly in response to the steam inlet pressure exceeding the restraining spring force and frictional forces."
10	S5.2.2.2.2	In the sixth paragraph, in accordance with response to RAI 5.2-11, deleted the text in the first bullet and changed the first sentence of the paragraph to read as follows: "In addition to the safety (steam pressure) mode of

		operation, the ten ADS SRVs are opened by the following mode of operation:"
11	S5.2.2.2.2	In the sixth paragraph and second bullet, updated the text to clarify the operation of the SRV in the ADS mode of operation as follows: "The ADS (power) mode of operation is initiated when an electrical signal is received at any of the solenoid valves located on the SRV assembly. The solenoid valve(s) open, allowing steam pressurization of the main disk piston, which pushes the main disk open, or nitrogen pressurization of the pneumatic cylinder piston lower side, which pushes the piston and the rod upwards to act on the main or pilot disk lifting mechanism to open the valve. This action allows steam to discharge through the SRV until the inlet-to-outlet pressure differential is near or equal to zero or the solenoid valve is closed."
12	S5.2.2.2.2	Moved text from tenth paragraph (second, third and fourth sentences) to the seventh paragraph and changed seventh paragraph to read as follows: "An SRV equipped with a pneumatic operator is so arranged that, if it malfunctions, it does not prevent the valve from opening when steam inlet pressure reaches the mechanical lift set pressure. A pneumatic accumulator and check valve are provided to support the remote-manual and ADS functions of the valve. The accumulator assures that the valve can be opened following a failure of the pneumatic pressure source. The accumulator capacity is sufficient for one actuation at drywell design pressure."
13	S5.2.2.2.2	In the seventh and eighth paragraphs: Replaced "spring lift" with "mechanical lift".
14	S5.2.2.2.2	In the ninth paragraph, updated text in accordance with response to RAI 5.2-20 to read as follows: "The ten ADS SRVs are power actuated and can be operated individually by remote manual controls from the main control room. The eight Non-ADS SRVs are not capable of remote actuation from the main control room."
15	S5.2.2.2.2	In the tenth paragraph, deleted second, third and fourth sentences (moved to seventh paragraph). In the first sentence, deleted "utilizes ten of the" and added "are utilized" after "SRVs".
16	S5.2.2.3.2	Changed the subtitle from "Anticipated Operational Occurrences (AOOs)" to "Pressurization Events". Changed from "transient" to "event" throughout the section. Changed

		the subtitle from “SRV & AOO Analysis Specification” to “SRV & Pressurization Event Analysis Specification”.
17	S5.2.2.3.2	In the sixth paragraph: Replaced “core loading” with “fuel cycle”, deleted “by the COL applicant” and deleted “(Subsection 5.2.6)”.
18	S5.2.2.3.2	In the sixth paragraph, first sentence, after “. . . occurring on high flux,” added “(i.e., MSIV Closure With Flux Scram special event)”. In the sixth paragraph, last sentence, replaced “the MSIV closure” with “a MSIV Closure With Flux Scram special”.
19	S5.2.2.3.2	Under SRV Capacities heading, first paragraph: Replaced “the reference AOO” with “pressurization event”.
20	S5.2.2.3.2	Under SRV Capacities heading, third paragraph: Added new second sentence in accordance with response to RAI 5.2-27 as follows: “Only one SRV is required to open to prevent exceeding the ASME limit in the ASME overpressure protection event. Eighteen SRVs are included in the ESBWR design. The other 17 SRVs are needed for the ATWS event”.
21	S5.2.2.3.3	Under Total SRV Capacity heading, first paragraph: In the fifth sentence, added “and” after “relief valve setpoint”.
22	S5.2.2.5	Added new paragraph in accordance with response to RAI 5.2-23 as follows: “Each SRV discharge line contains a temperature element, which provides an indication of seat leakage within the valve or confirmation of valve opening. The temperature element provides a signal to an indicator and an alarm in the main control room. Each SRV has a position indicator, which provides a signal to the main control room for indication of open and closed position”.
23	S5.2.3.2.2	Under Oxygen heading, second paragraph: In the second sentence, added “if a Hydrogen Water Chemistry System is installed” after “hydrogen injection,”
24	S5.2.3.2.2	Under Feedwater Hydrogen Addition Rate heading, added “A Hydrogen Water Chemistry (HWC) System is not part of the ESBWR Standard Plant design as stated in section 1.2.2.12.13. However, if a HWC System is connected,”.
25	S5.2.3.2.2	Under Reactor Water Dissolved Hydrogen heading, added “Under conditions of HWC,”.
26	S5.2.3.2.2	Under Main Steamline Radiation Level heading, deleted the last sentence in the first paragraph.

27	S5.2.3.3.3	In accordance with response to RAI 5.2-46, in the first sentence, deleted "Paragraph NB 2550 of" and added "Subsection NB" after "Section III". Added new second sentence as follows: "Seamless tubular products shall be examined according to NB-2550, welded tubular products according to NB-2560, and cast tubular products according to NB-2570".
28	S5.2.3.4.2	Under Regulatory Guide 1.71 heading, first paragraph: Added "VIII" after "Sections III" in accordance with response to RAI 10.3-5.
29	S5.2.4	First paragraph, changed from "AMSE" to "ASME".
30	S5.2.4	Second paragraph: Deleted "2001 Edition with 2003 Addenda" and replaced with "as specified in Table 1.9-22". Deleted "applicant" and replaced with "holder". Deleted "accordance with 10 CFR 50, Section 50.55a" and replaced with "Table 1.9-22". Deleted third sentence. In fourth sentence, deleted "and are based on the 2001 Edition of ASME Section XI with 2003 Addenda".
31	S5.2.4.2	First paragraph: Deleted second sentence and replaced with "Additionally, considerations for accessibility are defined in IWA-1500 of Section XI."
32	S5.2.4.3.1	Second paragraph: In accordance with response to RAI 5.2-56, deleted "categories B-E and" and replaced with "category".
33	S5.2.4.3.2	Under Ultrasonic Examination of the Reactor Vessel, heading, first paragraph: Deleted "2001 Edition with 2003 Addenda" and replaced with "specified in Table 1.9-22". Deleted "however, the inservice inspection program for the reactor vessel is the responsibility of the COL holder and any". Changed last sentence to read, "If accessibility is limited, an inservice inspection program relief request will be prepared and submitted for review by the NRC staff. . . . . ".
34	S5.2.4.3.2	Under Volumetric Ultrasonic Direct Examination heading, added new paragraph in accordance with response to RAI 5.2-53, RAI 5.2-54 and RAI 5.2-57 as follows: "Radiographic Examination ASME Section XI, IWA-2230 includes radiographic examination as a volumetric examination method. Section XI requires that the requirements of Article 2 of Section V be used for methodology. Radiography may be accomplished with x-rays or gamma rays and has historically been performed

		using film as the recording media. Due to ALARA, personnel access limitations in the work area when radiography is performed, radiography is not used as often as ultrasonic examination for Inservice Inspection. Use of computed and digital radiographic systems can result in greater latitude and reduced overall exposure times and make radiography a more practical examination method for Inservice Inspection. For the ESBWR, radiography may be used alone as a volumetric method or it may be used to supplement ultrasonic examination to improve coverage of the required examination volume".
35	S5.2.4.5	In accordance with response to RAI 5.2-56, deleted "and IWB 4000".
36	S5.2.5	Item (3): In accordance with response to RAI 5.2-1, added "both" after "permits" and added "and quantitative" after "qualitative".
37	S5.2.5	In accordance with response to RAI 5.2-5, added new paragraphs as follows: "The leak detection system required to perform isolation functions is classified Class 1E, Seismic Category I. The leak detection instruments that are utilized to automatically perform isolation functions are as follows: • Drywell pressure monitoring • Isolation Condenser Steamline and Condenser Return flow monitoring • Main Steamline High Flow monitoring • Reactor Vessel Low Water Level monitoring • Reactor Water Cleanup/Shutdown Cooling System flow monitoring • Main Steamline Tunnel Area Temperature monitoring • Isolation Condenser Radiation Leakage monitoring • Main Steamline Low Pressure monitoring • Main Steamline Low Vacuum monitoring The leak detection instruments not utilized for automatic isolation are as follows: • Drywell Floor Drain high Conductivity Waste (HCW) Sump monitoring

		• Drywell Equipment Drain Low Conductivity (LCW) Sump monitoring • Drywell Air Cooler Condensate Flow monitoring • Drywell Temperature monitoring • Drywell Fission Product monitoring • Reactor Vessel Head Flange Seal monitoring • Safety/Relief Valve (SRV) Leakage monitoring • Valve Stem Packing Leakage monitoring • Reactor Well Liner Leakage monitoring • Reactor building Floor and Equipment Drain Sump monitoring • Intersystem Leakage monitoring • Differential Temperature Monitoring in Equipment areas Of the leak detection instruments not being utilized for automatic isolation, only Fission Product Radiation monitoring subsystem needs to be seismically qualified and needs to follow the guidance of positions C.1 and C.2 of RG 1.29. Information pertaining to Seismic Design Classification can be found in Section 3.2. All other instruments in the non-automatic isolation category, because they are not required to be operational after a design basis earthquake, do not need to apply RG 1.29".
38	S5.2.5.1.1	Last paragraph: Changed from "Tables 5.2-8 and 5.2-9" to "Tables 5.2-6 and 5.2-7".
39	S5.2.5.1.2	Last paragraph: Changed from "Tables 5.2-8 and 5.2-9" to "Tables 5.2-6 and 5.2-7".
40	S5.2.5.2.3	Changed from "Tables 5.2-8 and 5.2-9" to "Tables 5.2-6 and 5.2-7".
41	S5.2.5.8	First paragraph: In accordance with response to RAI 5.2-5, changed paragraph to read as follows: "This Regulatory Guide (RG) specifies acceptable methods of implementing 10 CFR 50, Appendix A, GDC 30 with regard to the selection of leakage detection systems for the reactor coolant pressure boundary".
42	S5.2.5.8	Second paragraph: In accordance with response to RAI 5.2-5, replaced "from" with "for" and replaced "Regulatory Guide" with "RG".

43	S5.2.5.8	Third paragraph: In accordance with response to RAI 5.2-5, added "with an accuracy" after "detect leakage" and replaced "Regulatory Guide" with "RG".
44	S5.2.5.8	Fourth paragraph: In accordance with response to RAI 5.2-5, replaced "Regulatory Guide (RG)" with "RG".
45	S5.2.5.8	Seventh paragraph: In accordance with response to RAI 5.2-5, deleted first sentence and replaced with the following: "The monitoring instrumentation of the drywell floor drain sump, the air particulate radioactivity, and the drywell air cooler condensate flow rate are classified Class 1E, Seismic Category 1; and designed to operate during and following seismic events."
46	S5.2.5.8	Eighth paragraph: In accordance with response to RAI 5.2-5, changed last two sentences to read as follows: "Calibration of each leakage monitoring channel accounts for the necessary independent variables. This satisfies RG 1.45, Position C.7."
47	S5.2.5.8	Ninth paragraph: In accordance with response to RAI 5.2-5, changed to read as follows: "The monitoring instrumentation of the drywell floor drain sump, the air particulate radioactivity, and the drywell air cooler condensate flow rate are equipped with provisions to readily permit testing for operability and calibration during plant operation, thus satisfying RG 1.45, Position C.8."
48	S5.2.5.8	Tenth paragraph: In accordance with response to RAI 5.2-5, deleted in its entirety along with the four bullets.
49	S5.2.5.8	Eleventh paragraph: In accordance with response to RAI 5.2-5, deleted first sentence and replaced with: "Limiting conditions for identified and unidentified leakage and for the availability of various types of leakage detection instruments are established in the technical specifications."
50	S5.2.6	Added "Unit-Specific" after "COL". Deleted "Overpressure Protection" heading and corresponding paragraph. Under Preservice and Inservice Inspection Program Plan heading, replaced "responsibility" with "responsible" and deleted last sentence.
51	S5.2.7	In accordance with response to RAI 5.2-18, added new reference 5.2-9 as follows: "GE Nuclear Energy, "TRACG Application for Anticipated Operational Occurrences Transient Analysis", NEDE-32906P-A, Class III (Proprietary), Revision 1, April 2003,

		and NEDO-32906-A, Class I (non-proprietary), Revision 1, June 2003."
52	T5.2-1	Changed from "N-122-1" to "N-122-2" in accordance with response to RAI 3.12-2b.
53	T5.2-1	Deleted Code Case N-247 and all applicable text in accordance with response to RAI 3.12-2a. Added "Deleted" to empty table row.
54	T5.2-1	For Code Case N-318-5, deleted "Conditionally" in the Remarks column in accordance with response to RAI 3.12-2c.
55	T5.2-1	Deleted Code Case N-608 and all applicable text in accordance with response to RAI 3.12-2a. Added "Deleted" to empty table row.
56	T5.2-1	Under Code Case N-634, added new text in accordance with response to RAI 5.2-20 as follows: "This case allows attachment of non-pressure retaining materials meeting the requirements of NF-2000 to Subsection CC liners in the same manner as permitted under Subsection NE for MC components, except that welding and examination are required to meet the requirements of Subsection CC"
57	T5.2-1	Changed from "N-416-2" to "N-416-3" and deleted "Conditionally" in the Remarks column in accordance with response to RAI 3.12-2c.
58	T5.2-1	Deleted Code Case N-463-1 and all applicable text in accordance with response to RAI 3.12-2a. Added "Deleted" to empty table row.
59	T5.2-1	Deleted Code Case N-479-1 and all applicable text in accordance with response to RAI 3.12-2a. Added "Deleted" to empty table row.
60	T5.2-1	Deleted Code Case N-491-2 and all applicable text in accordance with response to RAI 5.2-50. Added "Deleted" to empty table row.
61	T5.2-1	Added new code case and the following text in accordance with response to RAI 5.2-50: <u>Number</u> N-613-1 <u>Title</u>

		Ultrasonic Examination of Penetration Nozzles in Vessels, Examination Category B-D, Item Nos. B3.10 and B3.90, Reactor Nozzle to Vessel Welds, Figs. IWB 2500-7(a), (b), and (c), Section XI, Division 1 <u>Applicable Equipment</u> Reactor Vessel <u>Remarks</u> Accepted Per RG 1.147
62	T5.2-2	In accordance with response to RAI 5.2-15, added the following to note (2): "The DPVs are not needed to mitigate the overpressure event"
63	T5.2-4	In accordance with responses to RAI 5.2-36 and 5.2-42, performed the following: General table update to clarify existing material specifications and add new material specifications for Reactor Pressure Vessel, Isolation Condenser, Reactor Water Cleanup/Shutdown Cooling Piping and Weld Filler Metals. Added "*" to Specification column heading and corresponding footnote as follows: "* Note: Carbon content of all RCPB wrought austenitic stainless steel (304/304L/316/316L) is 0.02% maximum"
64	T5.2-6	Moved the "X" for "IC Condensate Flow High" and "IC Steam Flow High" from "RWCU/SDC Lines" to "IC System Lines".
65	T5.2-8	Deleted entire table, which was a duplicate of Table 5.2-6.
66	T5.2-9	Deleted entire table, which was a duplicate of Table 5.2-7.
67	F5.2-1	Added "NON-ADS SRV" and relief valve symbol to main steamline in accordance with response to RAI 5.2-14.
68	S5.3.1.6.1	First paragraph: In accordance with response to RAI 5.3-5, added new text as follows: "The RPV material will not be exposed to normal operating temperatures below 274°C (525°F). Therefore, embrittlement due to temperature is of no concern."
69	S5.3.2.1	First paragraph: In accordance with response to RAI 5.3-6, added new text and changed the paragraph to read as follows:

		"The pressure/temperature limit curves in Figures 5.3-1 and 5.3-2 are representative for the ESBWR. They are based on the requirements of 10 CFR 50 Appendix G and Regulatory Guide 1.99."
70	S5.3.2.1	Second paragraph: In accordance with response to RAI 5.3-6, changed the first sentence into two sentences and added new text to read as follows: "The vessel flange, RPV head and flange areas, feedwater nozzles, bottom head and the core beltline areas were evaluated using the material initial RT_{NDT} data from the RPV specification. The operating limit curves are based on the most limiting locations."
71	S5.3.2.1	In accordance with response to RAI 5.3-6, added new paragraph as follows: "To calculate the adjusted reference temperature (accounting for the effects of irradiation in the vessel beltline region), the copper and nickel specification limits were used in combination with the peak fluence values and the methodology of RG 1.99, Revision 2. This is considered conservative since the actual RT_{NDT} values and chemical composition are normally much lower than the ones specified. Margins for the adjusted reference temperature calculation are as defined in RG 1.99 Revision 2."
72	S5.3.2.1	Third paragraph: In accordance with response to RAI 5.3-6, added the following text at beginning of the paragraph: "For each individual component (e.g., main steam nozzle), a finite element model is used to determine the stresses (pressure and thermal) for the transient events for normal and upset conditions. These stresses are then used to determine the applied K_I for each transient. The most limiting transient K_I for a given pressure and temperature is then compared to the minimum required K_I (note that the minimum temperature limits of 10 CFR 50 Appendix G also apply). The minimum required K_I is based upon the limiting RT_{NDT} of the materials for the component (determined per above), and calculated using the methodology of ASME Section III, Appendix G. For the pressure test condition, a safety factor of 1.5 is applied to K_{Ip} (K_I from primary membrane and bending stresses). For the core not critical and core critical conditions, a factor of 2.0 is applied to K_{IP})."
73	S5.3.2.1	Under Temperature Limits for ISI Hydrostatic and Leak Pressure Tests heading: In accordance with response to RAI 5.3-6, added "Representative" to beginning of sentence and

		changed “Pressure” to “pressure”. Added new sentence as follows: “Pressure/temperature curves using plant specific data such as materials, fluences and stresses will be developed prior to plant hydrostatic test.”
74	S5.3.2.1	Under Operating Limits During Heatup, Cooldown, and Core Operation heading: In accordance with response to RAI 5.3-6, added “representative” after “specifies” and added new sentence as follows: “Pressure/temperature curves using plant specific data such as materials, fluences and stresses will be developed prior to plant start-up.”
75	S5.3.3	Seventh paragraph, which contains description about Regulator Guide 1.2: In accordance with response to RAI 5.3-10, deleted all but the first sentence.
76	S5.3.3.1	Under Power Generation Design Bases heading, first bullet: Added “reactor” before “year” in accordance with response to RAI 5.3-11.
77	S5.3.3.2.1	Under Reactor Vessel heading, fifth paragraph: In accordance with response to RAI 5.3-2, added new sentence at end of paragraph as follows: “Use of Alloy 182 for welding of the CRD stub tubes in the bottom head is prohibited.”
78	S5.3.4	Added “Unit Specific” after “COL”.
79	S5.3.4	Under Fracture Toughness Data heading: In accordance with response to RAI 5.3-13, added “Pressure/Temperature Limits and” before “Fracture Toughness Data” and replaced the paragraph with the following: “The COL applicant will provide the pressure-temperature methodology in a Pressure and Temperature Limits Report (PTLR) for NRC review and approval with the plant specific P-T limits (Subsection 5.3.2) and fracture toughness data (Subsection 5.3.1.5) provided in a revised PTLR prior to criticality.”
80	T5.3-4	In accordance with response to RAI 5.3-12: Added “12” superscript in the RPV Fluence Analysis Results heading and added corresponding note “[12] Fluence values obtained from direct calculations.” Added “Expected peak neutron fluence at the inside surface (n/cm^2)” and “$< 2.07 \times 10^{19}$” Added “Expected peak azimuthal locations (first quadrant)”

		and “11.5°, 78.5°”
81	F5.3-1	In accordance with response to RAI 5.3-6, added “(Representative curve for the ESBWR)” to the figure title.
82	F5.3-2	In accordance with response to RAI 5.3-6, added “(Representative curve for the ESBWR)” to the figure title.
83	S5.4.6.1	Deleted “Safety”
84	S5.4.6.1	Added new header, “5.4.6.1.1 Safety Design Bases”.
85	S5.4.6.1.1	Under Functions heading, first paragraph: Deleted first sentence. Under Functions heading, second paragraph: Deleted first bullet.
86	S5.4.6.1.1	Under Functions heading: In accordance with response to RAI 5.4.46, added new text to second bullet as follows: “(See Subsection 15.5.4.3)”
87	S5.4.6.1.1	Under General System Requirements heading, first paragraph: In accordance with responses to RAI 5.4-12 and RAI 5.4-31, added the following text: Added “i.e., to 215.6°C (420°F) or lower within 36 hours from reactor shutdown” between “conditions” and “with” in the first sentence. Added new sentence “The IC heat exchangers are independent of plant AC power, they function whenever normal heat removal systems are unavailable, to maintain reactor pressure and temperature below limits.”
88	S5.4.6.1.2	Added new header, “Power Generation Design Bases”.
89	S5.4.6.1.2	Added new first paragraph: “The ICS automatically limits the reactor pressure and prevents Safety Relief Valve (SRV) operation following an Anticipated Operational Occurrence (AOO).”
90	S5.4.6.1.2	Added new second paragraph: “The ICS removes excess sensible and core decay heat from the reactor, in a passive way and with minimal loss of coolant inventory from the reactor, when the normal heat removal system is unavailable, following AOOs and any event that results in containment isolation.”
91	S5.4.6.2.1	First paragraph, first sentence: Deleted “totally”.
92	S5.4.6.2.2	First paragraph, first sentence: Deleted “totally”.
93	S5.4.6.2.2	Third paragraph, third bullet: Deleted “hydrogen (from the hydrogen water chemistry control additions) or” and replaced “the excess of air from the feedwater” with “an

		excess of noncondensable gases".
94	S5.4.6.2.2	Third paragraph, fifth bullet: Replaced "motor" with "nitrogen". Replaced "These two valves are closed during normal operation station power operations." With "Two different valve actuator types are used to ensure open flow path by eliminating common mode failure." Replaced "To start an IC into operation, the motor-operated condensate return valve or condensate return bypass valve is opened, whereupon …" with "To start an IC into operation, the nitrogen motor-operated condensate return valve and condensate return bypass valves are opened, whereupon …"
95	S5.4.6.2.2	Third paragraph, sixth bullet: Deleted "remote".
96	S5.4.6.2.2	Third paragraph, seventh bullet: Added in-line vessel description as follows: "Located on the condensate return line, downstream from valve F004 is an in-line vessel. The inline vessel is located on each ICS train to provide the additional condensate volume for the RPV. The volume of each vessel is no less than $9m^3$. The added inventory the vessel provides allows use of a single level logic for ECCS initiation and adjusts the level setpoint to the level that will not fall to or below the Level 1 setpoint during a Loss of Feedwater or Loss of Preferred Power."
97	S5.4.6.2.2	Third paragraph, eighth bullet: Added Dryer/Separator Pool description as follows: "The Dryer/Separator pool shall be designed to have sufficient water volume to provide makeup water to the IC/PCCS pools for the initial 72 hours of a LOCA."
98	S5.4.6.2.2	Fourth paragraph, first bullet: Replaced "motor" with "solenoid".
99	S5.4.6.2.2	Seventh paragraph, first sentence: Replaced "Pool water can heat up to about 101°C (214°F); …" with "When the heat exchanger goes into operation, the pool water can heat up to about 101°C (214°F) and start to boil; steam formed …"
100	S5.4.6.2.2	Ninth paragraph: In accordance with response to RAI 5.4-45, added "and level monitoring" between "operation" and "is provided".
101	S5.4.6.2.3	Under Isolation Condenser Operation heading, first paragraph, fourth bullet: Deleted "level" and replaced "Level 1.5" with "Level 1"

102	S5.4.6.2.3	Under Isolation Condenser Operation heading, first paragraph, fifth bullet: Replaced "Loss of power generation busses;" with "Loss of Feed Water (loss of power to 2-out-of-4 feed water pumps) in Reactor Run Mode."
103	S5.4.6.2.3	Under Isolation Condenser Operation heading, first paragraph, sixth bullet: Deleted "remote".
104	S5.4.6.2.3	Under Isolation Condenser Operation heading, last paragraph: Added the following to the second sentence in accordance with response to RAI 5.4-23: "see Section 6.3"
105	S5.4.6.3	In accordance with response to RAI 5.4-24 and 5.4-25, added new fifth paragraph as follows: "For its function to provide makeup water to the RPV during a LOCA, the ICS is designed to meet the requirements of GDC 2, 17, 35, 36 and 37 and 10 CFR 50.46 in conjunction with the other ECCS systems. Conformance to these criteria is discussed in Section 6.3, Emergency Core Cooling Systems."
106	S5.4.6.4	Under Testing heading, first paragraph: In accordance with response to RAI 5.4-52, added "at five-year intervals" at end of first sentence.
107	S5.4.6.4	Under Testing heading, fifth paragraph: Deleted "remote" and replaced "by their status light." with "in the main control room."
108	S5.4.6.5	Eleventh paragraph: Replaced "motor" with "solenoid". Added "and manual operated valve …" between "isolaton valve" and "to mount".
109	S5.4.7	In accordance with response to RAI 5.4-11, added new items G and H as follows: G. GDC 1, as it relates to the quality standards and records for structures, systems and components important to safety. H. GDC 3, as it relates to fire protection for structures, systems and components important to safety.
110	S5.4.8.1.2	Under Demineralizer heading: In accordance with response to RAI 5.4-3 and RAI 5.4-5, added new paragraphs as follows: "The resin transfer system is designed to prevent resin traps in sluice lines. Consideration is given in the design to avoid resins collecting in valves, low points or stagnant areas."

		"Interlocks are provided to prevent inadvertent opening of the demineralizer resin addition and backflushing valves during normal operation."
111	S5.4.8.1.2	Under Overboarding heading, third paragraph: In the first sentence, replaced "a combination of RWCU/SDC pump flow and pressure control" with "an overboard flow control valve". In the second sentence, deleted "pressure". In the third sentence, changed from "pressure control station" to "control station" and replaced "a pressure control valve" with "the overboard flow control valve".
112	S5.4.8.1.2	Under Overboarding heading: Deleted fourth paragraph.
113	S5.4.8.1.2	Under Overboarding heading, fifth and seventh paragraphs: Changed from "pressure control valve" to "overboard flow control valve".
114	S5.4.8.1.5	First paragraph: Deleted last sentence.
115	S5.4.8.1.5	Under Overboard Flow Control Valves heading, first paragraph: deleted "from the main control room with a remote manual controller" and replaced with "by the Feedwater Control System"
116	S5.4.8.2.2	Under Refueling heading: In accordance with response to RAI 9.1-7, deleted "supplement the FAPCS spent fuel heat removal capacity during refueling (or other times). It also can".
117	S5.4.9.2	In the seventh paragraph: Added new sentence, "There is a connection at each of the two lines for detection and monitoring of differential pressure between the two feedwater lines."
118	S5.4.9.5	In the first sentence, deleted "or feedwater lines". Added new sentences, "There is instrumentation associated with the RCPB portion of the feedwater lines. Differential pressure instrumentation detects and monitors the differential pressure between the two feedwater lines and provides indication on display units in the control room."
119	S5.4.12	First paragraph: In accordance with response to RAI 5.4-17, added items D, E and F as follows: D. 10 CFR 50.49 with respect to environmental qualification of electrical equipment necessary to operate the reactor coolant vent system. E. GDC 17 with respect to the provision of normal and emergency power for the vent system. components

		F. GDC 19 with respect to the vent system controls being operable from the control room.
120	S5.4.12	Second paragraph: In accordance with response to RAI 5.4-15: Added new first sentence, "The ESBWR meets the recommendations of TMI action plan item II.B.1 in 10 CFR 50.34(f)(2)(vi) regarding the capability of high point venting of noncondensable gases from the reactor coolant system." In second sentence, added "continuously" after "IC steam lines are".
121	S5.4.12	Second paragraph: In accordance with response to RAI 5.4-18, added new sentences as follows: "Position indication and controls for opening and closing the valves are provided in the control room." "The procedure for operation of the RPV head vent system is discussed in Subsection 5.4.12.1."
122	S5.4.12	Third paragraph: In accordance with response to RAI 5.4-16 and RAI 5.4-18, added new sentences as follows: "When the RPV is in an isolated condition, redundancy for venting the reactor coolant system is provided by the RPV head vent line and the SRVs." "These valves are subjected to an Environmental Qualification program as described in Section 3.11."
123	S5.4.12	In accordance with response to RAI 5.4-17, added new paragraph as follows: "GDC 17 is met by an on-site electric power system that provides normal and emergency power to permit operation of the ROV head vent line valves. GDC 19 is met by controls and indication that permit operation of the valves from the main control room. The RPV head vent system is not part of the ECCS and is not required to assure natural circulation core cooling. Therefore, GDC 36 is not applicable."
124	S5.4.12	In accordance with response to RAI 5.4-18, added new paragraphs as follows: "For RCPB isolation purposes during reactor power operation, redundancy is provided by the use of two motor operated valves in series in the piping that vents the RPV to the Equipment and Floor Drain Sump. Either or both valves isolate the piping. Failure modes consist of loss of power supply, failure of the control system and mechanical failure

		in the valve. In the event that one of the valves experiences a failure, there is the second valve in series that performs the isolation function. Indication of open and close position and temperature downstream of the second valve are available to operators in the control room." "There is a connection at the RPV flange area that connects the internal integral head vent piping to the external head vent piping. The piping is two inches in diameter. The vent piping directs air and non-condensable gases from the RPV to either the Equipment and Floor Drain Sump or one of the main steamlines. The vent piping permits air to be released from the RPV so that the vessel can be filled with water for hydrostatic testing, vents gases during reactor operation and reactor shutdown and provides the upper tap for RPV level measurement during reactor shutdown." "The diameter of the vent line piping is much smaller than the main steam line piping. Therefore, a break in this piping is bounded by a main steam line break, which is addressed in Section 6.3."
125	S5.4.12	In accordance with response to RAI 5.4-18, added new header "5.4.12.1 Operation of RPV Head Vent System" and section 5.4.12.1 as follows: "Prior to reactor startup, deaeration of the reactor water may be performed. This requires closing the two motor operated valves in the vent piping leading to the Equipment and Floor Drain Sump and opening the motor operated valve in the vent piping connected to the main steamline. These valve positions are maintained during power operation. During reactor shutdown and after the plant reaches cold shutdown conditions, the two valves in the vent piping leading to the Equipment and Floor Drain Sump are opened and the valve in the piping connected to the main steamline is closed."
126	S5.4.15	Added "Unit Specific" after "COL".
127	T5.4-2	Changed actuator type from "MO" to "NO" for Steam Outer Isolation, Condensate Return Inner Isolation and Condensate return. Changed actuator type from "MO" to "SO" for Lower Header Bypass Vent (two places) and Purge. Changed Size from "25" to "20" for Upper Header Vent (two places). In the Legend, deleted "MO = Electric Motor Operated".
128	F5.4-4	In accordance with response to RAI 5.4-22, added new figure titled, "Isolation Condenser System Simplified Process Diagram". Process Flow data is not added because it is proprietary in accordance with response to RAI 5.4-22.