### Form 4.1-BWR Boiling-Water Reactor Examination Outline

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| Facility: Date of Exam: | | | | | | | | | | | | | | | | | | | | |
| Tier | Group | RO K/A Category Points | | | | | | | | | | | | | | SRO-Only Points | | | | |
| K1 | K2 | | K3 | K4 | K5 | | K6 | A1 | A2 | A3 | A4 | G | Total | A2 | | G | | Total |
| 1.  Emergency and Abnormal Plant Evolutions | 1 |  |  | |  | N/A | | | |  |  | N/A | |  | 20 |  | |  | | 7 |
| 2 |  |  | |  |  |  |  | 6 |  | |  | | 3 |
| Tier Totals |  |  | |  |  |  |  | 26 |  | |  | | 10 |
| 2.  Plant  Systems | 1 |  |  | |  |  |  | |  |  |  |  |  |  | 26 |  | |  | | 5 |
| 2 |  |  | |  |  |  | |  |  |  |  |  |  | 11 |  |  |  | | 3 |
| Tier Totals |  |  | |  |  |  | |  |  |  |  |  |  | 37 |  | |  | | 8 |
| 3.  Generic Knowledge and Abilities Categories | CO | | | EC | | | | | | RC | | EM | | | 6 | CO | EC | RC | EM | 7 |
| 2 | | | 2 | | | | | | 1 | | 1 | | |  |  |  |  |
| 4. Theory | Reactor Theory | | | | | | | Thermodynamics | | | | | | | 6 |  | | | | |
| 3 | | | | | | | 3 | | | | | | |

Notes: CO = Conduct of Operations; EC = Equipment Control; RC = Radiation Control;

EM = Emergency Procedures/Plan

\* These systems/evolutions may be eliminated from the sample when Revision 2 of the K/A catalog is used to develop the sample plan

\*\* These systems/evolutions are only included as part of the sample (as applicable to the facility) when Revision 2 of the K/A catalog is used to develop the sample plan

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| Form 4.1-BWR BWR Examination Outline Page 2 Emergency and Abnormal Plant Evolutions—Tier 1/Group 1 (RO/SRO) | | | | | | | | | |
| E/APE # / Name | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | IR | # |
| 295001 (APE 1) Partial or Complete Loss of Forced Core Flow Circulation & 4 |  |  |  |  |  |  |  |  |  |
| 295003 (APE 3) Partial or Complete Loss of AC Power |  |  |  |  |  |  |  |  |  |
| 295004 (APE 4) Partial or Total Loss of DC Power |  |  |  |  |  |  |  |  |  |
| 295005 (APE 5) Main Turbine Generator Trip |  |  |  |  |  |  |  |  |  |
| 295006 (APE 6) Scram |  |  |  |  |  |  |  |  |  |
| 295016 (APE 16) Control Room Abandonment |  |  |  |  |  |  |  |  |  |
| 295018 (APE 18) Partial or Complete Loss of CCW |  |  |  |  |  |  |  |  |  |
| 295019 (APE 19) Partial or Complete Loss of Instrument Air |  |  |  |  |  |  |  |  |  |
| 295021 (APE 21) Loss of Shutdown Cooling |  |  |  |  |  |  |  |  |  |
| 295023 (APE 23) Refueling Accidents |  |  |  |  |  |  |  |  |  |
| 295024 (EPE 1) High Drywell Pressure |  |  |  |  |  |  |  |  |  |
| 295025 (EPE 2) High Reactor Pressure |  |  |  |  |  |  |  |  |  |
| 295026 (EPE 3) Suppression Pool High Water Temperature |  |  |  |  |  |  |  |  |  |
| 295027 (EPE 4) High Containment Temperature (Mark III Containment Only) |  |  |  |  |  |  |  |  |  |
| 295028 (EPE 5) High Drywell Temperature (Mark I and Mark II only) |  |  |  |  |  |  |  |  |  |
| 295030 (EPE 7) Low Suppression Pool Water Level |  |  |  |  |  |  |  |  |  |
| 295031 (EPE 8) Reactor Low Water Level |  |  |  |  |  |  |  |  |  |
| 295037 (EPE 14) Scram Condition Present and Reactor Power Above APRM Downscale or Unknown |  |  |  |  |  |  |  |  |  |
| 295038 (EPE 15) High Offsite Radioactivity Release Rate |  |  |  |  |  |  |  |  |  |
| 600000 (APE 24) Plant Fire On Site |  |  |  |  |  |  |  |  |  |
| 700000 (APE 25) Generator Voltage and Electric Grid Disturbances |  |  |  |  |  |  |  |  |  |
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| K/A Category Totals: |  |  |  |  |  |  | Group Point Total: | | 20/7 |

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| Form 4.1-BWR BWR Examination Outline Page 3 Emergency and Abnormal Plant Evolutions—Tier 1/Group 2 (RO/SRO) | | | | | | | | | |
| E/APE # / Name | K1 | K2 | K3 | A1 | A2 | G | K/A Topic(s) | IR | # |
| 295002 (APE 2) Loss of Main Condenser Vacuum |  |  |  |  |  |  |  |  |  |
| 295007 (APE 7) High Reactor Pressure |  |  |  |  |  |  |  |  |  |
| 295008 (APE 8) High Reactor Water Level |  |  |  |  |  |  |  |  |  |
| 295009 (APE 9) Low Reactor Water Level |  |  |  |  |  |  |  |  |  |
| 295010 (APE 10) High Drywell Pressure |  |  |  |  |  |  |  |  |  |
| 295011 (APE 11) High Containment Temperature (Mark III Containment only) |  |  |  |  |  |  |  |  |  |
| 295012 (APE 12) High Drywell Temperature |  |  |  |  |  |  |  |  |  |
| 295013 (APE 13) High Suppression Pool Water  Temperature/ 5 |  |  |  |  |  |  |  |  |  |
| 295014 (APE 14) Inadvertent Reactivity  Addition |  |  |  |  |  |  |  |  |  |
| 295015 (APE 15\*\*) Incomplete Scram |  |  |  |  |  |  |  |  |  |
| 295017 (APE 17) High Offsite Release  Rate |  |  |  |  |  |  |  |  |  |
| 295020 (APE 20) Inadvertent Containment  Isolation |  |  |  |  |  |  |  |  |  |
| 295022 (APE 22) Loss of Control Rod Drive Pumps |  |  |  |  |  |  |  |  |  |
| 295029 (EPE 6) High Suppression Pool Water Level |  |  |  |  |  |  |  |  |  |
| 295032 (EPE 9) High Secondary Containment Area Temperature |  |  |  |  |  |  |  |  |  |
| 295033 (EPE 10) High Secondary Containment Area Radiation Levels |  |  |  |  |  |  |  |  |  |
| 295034 (EPE 11) Secondary Containment Ventilation High Radiation |  |  |  |  |  |  |  |  |  |
| 295035 (EPE 12) Secondary Containment High Differential Pressure |  |  |  |  |  |  |  |  |  |
| 295036 (EPE 13) Secondary Containment High Sump/Area Water Level |  |  |  |  |  |  |  |  |  |
| 500000 (EPE 16) High Containment Hydrogen  Concentration |  |  |  |  |  |  |  |  |  |
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| K/A Category Point Totals: |  |  |  |  |  |  | Group Point Total: | | 6/3 |

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| Form 4.1-BWR BWR Examination Outline Page 4 Plant Systems—Tier 2/Group 1 (RO/SRO) | | | | | | | | | | | | | | |
| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic(s) | IR | # |
| 203000 (SF2, SF4 RHR/LPCI)  RHR/LPCI: Injection Mode |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 205000 (SF4 SCS) Shutdown Cooling |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 206000 (SF2, SF4 HPCI)  High-Pressure Coolant Injection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 207000 (SF4 IC) Isolation (Emergency) Condenser |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 209001 (SF2, SF4 LPCS)  Low-Pressure Core Spray |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 209002 (SF2, SF4 HPCS)  High-Pressure Core Spray |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 211000 (SF1 SLCS) Standby Liquid Control |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 212000 (SF7 RPS) Reactor Protection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 215003 (SF7 IRM)  Intermediate-Range Monitor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 215004 (SF7 SRMS) Source-Range Monitor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 215005 (SF7 PRMS) Average Power Range Monitor/Local Power Range Monitor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 217000 (SF2, SF4 RCIC) Reactor  Core Isolation Cooling |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 218000 (SF3 ADS) Automatic Depressurization |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 223002 (SF5 PCIS) Primary  Containment Isolation/Nuclear Steam Supply Shutoff |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 239002 (SF3 SRV) Safety Relief Valves |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 259002 (SF2 RWLCS) Reactor Water Level Control |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 261000 (SF9 SGTS) Standby Gas Treatment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 262001 (SF6 AC) AC Electrical Distribution |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 262002 (SF6 UPS) Uninterruptable Power Supply (AC/DC) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 263000 (SF6 DC) DC Electrical Distribution |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 264000 (SF6 EGE) Emergency Generators (Diesel/Jet) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 300000 (SF8 IA) Instrument Air |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 400000 (SF8 CCW) Component Cooling Water |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 510000 (SF4 SWS\*) Service Water |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| K/A Category Point Totals: |  |  |  |  |  |  |  |  |  |  |  | Group Point Total: | | 26/5 |

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| Form 4.1-BWR BWR Examination Outline Page 5 Plant Plant Systems—Tier 2/Group 2 (RO/SRO) | | | | | | | | | | | | | | | |
| System # / Name | K1 | K2 | K3 | K4 | K5 | K6 | A1 | A2 | A3 | A4 | G | K/A Topic(s) | IR | # |
| 201001 (SF1 CRDH) CRD Hydraulic |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201002 (SF1 RMCS) Reactor Manual Control |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201003 (SF1 CRDM) Control Rod and Drive Mechanism |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201004 (SF7 RSCS) Rod Sequence Control |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201005 (SF1, SF7 RCIS) Rod Control and Information |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 201006 (SF7 RWMS) Rod Worth Minimizer |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 202001 (SF1, SF4 RS) Recirculation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 202002 (SF1 RSCTL) Recirculation Flow Control |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 204000 (SF2 RWCU) Reactor Water Cleanup |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 214000 (SF7 RPIS) Rod Position Information |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 215001 (SF7 TIP) Traversing In-Core Probe |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 215002 (SF7 RBMS) Rod Block Monitor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 216000 (SF7 NBI) Nuclear Boiler Instrumentation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 219000 (SF5 RHR SPC) RHR/LPCI:  Torus/Suppression Pool Cooling Mode |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 223001 (SF5 PCS) Primary Containment and Auxiliaries |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 226001 (SF5 RHR CSS) RHR/LPCI: Containment  Spray Mode |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 230000 (SF5 RHR SPS) RHR/LPCI:  Torus/Suppression Pool Spray Mode |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 233000 (SF9 FPCCU) Fuel Pool Cooling/Cleanup |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 234000 (SF8 FH) Fuel Handling Equipment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 239001 (SF3, SF4 MRSS) Main and Reheat Steam |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 239003 (SF9 MSIVLC) Main Steam Isolation Valve Leakage Control |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 241000 (SF3 RTPRS) Reactor/Turbine Pressure Regulating |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 245000 (SF4 MTGEN) Main Turbine Generator/Auxiliary |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 256000 (SF2 CDS) Condensate |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 259001 (SF2 FWS) Feedwater |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 268000 (SF9 RW) Radwaste |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 271000 (SF9 OG) Offgas |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 272000 (SF7, SF9 RMS) Radiation Monitoring |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 286000 (SF8 FPS) Fire Protection |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 288000 (SF9 PVS) Plant Ventilation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 290001 (SF5 SC) Secondary Containment |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 290003 (SF9 CRV) Control Room Ventilation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 290002 (SF4 RVI) Reactor Vessel Internals |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 510001 (SF8 CWS\*) Circulating Water |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| K/A Category Point Totals: |  |  |  |  |  |  |  |  |  |  |  | Group Point Total: |  | 11/3 |

### Form 4.1-COMMON Common Examination Outline

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Facility: Date of Exam: | | | | | | | | | |
| **Generic Knowledge and Abilities—Tier 3 (RO/SRO)** | | | | | | | | | |
| Category | K/A # | | Topic | RO | | | SRO-Only | | |
| IR | | # | IR | | # |
| 1.  Conduct of Operations | 2.1. | |  |  | |  |  | |  |
| 2.1. | |  |  | |  |  | |  |
| 2.1. | |  |  | |  |  | |  |
| 2.1. | |  |  | |  |  | |  |
| Subtotal | | | N/A | |  | N/A | |  |
| 2.  Equipment Control | 2.2. | |  |  | |  |  | |  |
| 2.2. | |  |  | |  |  | |  |
| 2.2. | |  |  | |  |  | |  |
| 2.2. | |  |  | |  |  | |  |
| Subtotal | | | N/A | |  | N/A | |  |
| 3.  Radiation Control | 2.3. | |  |  | |  |  | |  |
| 2.3. | |  |  | |  |  | |  |
| 2.3. | |  |  | |  |  | |  |
| Subtotal | | | N/A | |  | N/A | |  |
| 4.  Emergency Procedures/  Plan | 2.4. | |  |  | |  |  | |  |
| 2.4. | |  |  | |  |  | |  |
| 2.4. | |  |  | |  |  | |  |
| Subtotal | | | N/A | |  | N/A | |  |
| **Tier 3 Point Total** | | | |  | | **6** |  | | **7** |
| **Theory—Tier 4 (RO)** | | | | | | | | | |
| Category | | K/A # | Topic | | RO | | | | |
| IR | | | # | |
| Reactor Theory | | 6 |  | |  | | |  | |
| 6 |  | |  | | |  | |
| 6 |  | |  | | |  | |
| Subtotal | | | N/A | | |  | |
| Thermodynamics | | 6 |  | |  | | |  | |
| 6 |  | |  | | |  | |
| 6 |  | |  | | |  | |
| Subtotal | | | N/A | | |  | |
| **Tier 4 Point Total** | | | | |  | | | **6** | |

### Form 4.1-1 Record of Rejected Knowledge and Abilities

Refer to Examination Standard (ES)-4.2, “Developing Written Examinations,” Section B.3, for deviations from the approved written examination outline.

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| Tier/Group | Randomly Selected K/A | Reason for Rejection |
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