

PWR Examination Outline

Form ES-401-2

| Facility: Three Mile Island | | | | | | | | | | Date of Exam: 06/28/17 | | | | | | | | | |
|--|-------------|------------------------|--------|--------|--------|--------|--------|--------|--------|------------------------|--------|----|-------|-----------------|----|-------|----|---|---|
| Tier | Group | RO K/A Category Points | | | | | | | | | | | | SRO-Only Points | | | | | |
| | | K 1 | K 2 | K 3 | K 4 | K 5 | K 6 | A 1 | A 2 | A 3 | A 4 | G* | Total | A2 | G* | Total | | | |
| 1. Emergency & Abnormal Plant Evolutions | 1 | 2 | 1 | 5 | N/A | | | 2 | 6 | N/A | | | 2 | 18 | | | 6 | | |
| | 2 | 1 | 1 | 2 | | | | 1 | 3 | | | | 1 | 9 | | | 4 | | |
| | Tier Totals | 3 | 2 | 7 | | | | 3 | 9 | | | | 3 | 27 | | | 10 | | |
| 2. Plant Systems | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 28 | | | 5 | | | |
| | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 1 | 1 | 2 | 10 | | | 3 | | | |
| | Tier Totals | 4 | 2 | 3 | 4 | 2 | 3 | 3 | 5 | 4 | 3 | 5 | 38 | | | 8 | | | |
| 3. Generic Knowledge and Abilities Categories | | | | | 1 2 | | 2 3 | | 3 2 | | 4 3 | | 10 | | 1 | 2 | 3 | 4 | 7 |
| <p>Note:</p> <ol style="list-style-type: none"> Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 Radiation Control K/A is allowed if the K/A is replaced by a K/A from another Tier 3 Category). The point total for each group and tier in the proposed outline must match that specified in the table. The final point total for each group and tier may deviate by ± 1 from that specified in the table based on NRC revisions. The final RO exam must total 75 points and the SRO-only exam must total 25 points. Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted with justification; operationally important, site-specific systems/evolutions that are not included on the outline should be added. Refer to Section D.1.b of ES-401 for guidance regarding the elimination of inappropriate K/A statements. Select topics from as many systems and evolutions as possible; sample every system or evolution in the group before selecting a second topic for any system or evolution. Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories. The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As. On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams. For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43. <p>G* Generic K/As</p> | | | | | | | | | | | | | | | | | | | |

Statement Detailing Method of Written Outline Generation:

- Original K/A's for Three Mile Island ILT Class 16-01 NRC Written Examination were provided by NRC Lead Examiner Joseph D'Antonio.
- Replacement K/A's were selected via a random number generator.

Statement regarding potential overlap of events between NRC and CERT Scenarios:

- NRC Scenario #2 and Cert Scenario #2 both involve OTSG tube ruptures but have the following differences:
 - Different OTSGs are involved.
 - In NRC Scenario #2 a Reactor Coolant Pump is secured earlier in the scenario, thus changing the procedure flowpath after subcooling margin is minimized.
 - Offsite dose requires isolation of the 'B' OTSG in Cert Scenario #2, which does not apply to NRC Scenario #2.

| ES-401 | | PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO) | | | | | | Form ES-401-2 | |
|---|--------|--|--------|--------|--------|----|---|---------------|----|
| E/APE # / Name / Safety Function | K 1 | K 2 | K 3 | A 1 | A 2 | G* | K/A Topic(s) | IR | # |
| 000007 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1 | | | | | | X | 2.1.20 Ability to interpret and execute procedure steps. | 4.6/4.6 | 1 |
| 000008 Pressurizer Vapor Space Accident / 3 | | | | | | | | | |
| 000009 Small Break LOCA / 3 | | X | | | | | EK2.03 Knowledge of the interrelations between the small break LOCA and the following: S/Gs | 3.0/3.3 | 2 |
| 000011 Large Break LOCA / 3 | | | | | | | | | |
| 000015/17 RCP Malfunctions / 4 | | | | X | | | AA1.09 Ability to operate and / or monitor the following as they apply to Reactor Coolant Pump Malfunctions (Loss of RC Flow): RCS temperature detection subsystem | 3.1/3.2 | 3 |
| 000022 Loss of Rx Coolant Makeup / 2 | X | | | | | | AK1.03 Knowledge of the operational implications of the following concepts as they apply to Loss of Reactor Coolant Makeup: Relationship between charging flow and PZR level | 3.0/3.4 | 4 |
| 000025 Loss of RHR System / 4 | | | | | X | | AA2.01: Ability to determine and interpret the following as they apply to the Loss of Residual Heat Removal System: Proper amperage of running LPI/decay heat removal/RHR pumps(s) | 2.7/2.9 | 67 |
| 000026 Loss of Component Cooling Water / 8 | | | X | | | | AK3.03 Knowledge of the reasons for the following responses as they apply to Loss of Component Cooling Water: Guidance actions contained in EOP for Loss of CCW | 4.0/4.2 | 5 |
| 000027 Pressurizer Pressure Control System Malfunction / 3 | | | | | X | | AA2.12 Ability to determine and interpret the following as they apply to the Pressurizer Pressure Control Malfunctions: PZR level | 3.7/3.8 | 6 |
| 000029 ATWS / 1 | | | | X | | | EA1.01 Ability to operate and monitor the following as they apply to a ATWS: Charging pumps | 3.4/3.1 | 46 |
| 000038 Steam Gen. Tube Rupture / 3 | | | | | X | | EA2.01 Knowledge of the interrelations between the and the following a SGTR: Sensors and detectors | 2.4/2.5 | 73 |
| 000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4 | | | | | X | | AA2.02 Ability to determine and interpret the following as they apply to Steam Line Rupture: Conditions requiring a reactor trip. | 4.6/4.7 | 64 |
| 000054 (CE/E06) Loss of Main Feedwater / 4 | | | | | | | | | |
| 000055 Station Blackout / 6 | | | | | X | | EA2.04 Ability to determine or interpret the following as they apply to a Station Blackout: Instruments and controls operable with only dc battery power available | 3.7/4.1 | 7 |
| 000056 Loss of Off-site Power / 6 | | | X | | | | AK3.02 Knowledge of the reasons for the following responses as they apply to Loss of Offsite Power :Actions contained in EOP for loss of offsite power | 4.4/4.7 | 8 |
| 000057 Loss of Vital AC Inst. Bus / 6 | | | X | | | | AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Vital AC Instrument Bus: Actions contained in EOP for loss of vital ac electrical instrument bus | 4.1/4.1 | 9 |

| | | | | | | | | | |
|--|---|---|---|---|---|---|---|---------|----|
| 000058 Loss of DC Power / 6 | | | X | | | | AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of DC Power: Use of dc control power by D/Gs | 3.4/3.7 | 10 |
| 000062 Loss of Nuclear Svc Water / 4 | | | X | | | | AK3.02 Knowledge of the reasons for the following responses as they apply to the Loss of Nuclear Service Water: The automatic actions (alignments) within the nuclear service water resulting from the actuation of the ESFAS | 3.6/3.9 | 11 |
| 000065 Loss of Instrument Air / 8 | | | | | X | | AA2.07 Ability to determine and interpret the following as they apply to the Loss of Instrument Air: When to trip reactor if instrument air pressure is de-creasing. | 3.6/4.2 | 66 |
| W/E04 LOCA Outside Containment / 3 | | | | | | | | | |
| W/E11 Loss of Emergency Coolant Recirc. / 4 | | | | | | | | | |
| BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4 | X | | | | | | EK1.2 Knowledge of the operational implications of the following concepts as they apply to the (Inadequate Heat Transfer): Normal, abnormal and emergency operating procedures associated with (Inadequate Heat Transfer). | 4.0/4.2 | 47 |
| 000077 Generator Voltage and Electric Grid Disturbances / 6 | | | | | | X | 2.4.11 Knowledge of abnormal condition procedures. | 4.0/4.2 | 49 |
| | | | | | | | | | |
| | | | | | | | | | |
| K/A Category Totals: | 2 | 1 | 5 | 2 | 6 | 2 | Group Point Total: | 18 | 18 |

| ES-401 | | PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO) | | | | | | Form ES-401-2 | |
|--|--------|--|--------|--------|--------|----|---|---------------|----|
| E/APE # / Name / Safety Function | K 1 | K 2 | K 3 | A 1 | A 2 | G* | K/A Topic(s) | IR | # |
| 000001 Continuous Rod Withdrawal / 1 | | | | | X | | AA2.05 Ability to determine and interpret the following as they apply to Continuous Rod Withdrawal :Uncontrolled rod withdrawal, from available indications | 4.4/4.6 | 12 |
| 000003 Dropped Control Rod / 1 | | | | | | | | | |
| 000005 Inoperable/Stuck Control Rod / 1 | | | | | | | | | |
| 000024 Emergency Boration / 1 | | | | | | X | 2.2.12 Knowledge of surveillance procedures. | 3.7/4.1 | 60 |
| 000028 Pressurizer Level Malfunction / 2 | X | | | | | | AK1.01 Knowledge of the operational implications of the following concepts as they apply to Pressurizer Level Control Malfunctions: PZR reference leg leak abnormalities | 2.8/3.1 | 13 |
| 000032 Loss of Source Range NI / 7 | | | X | | | | AK3.01 Knowledge of the reasons for the following responses as they apply to the Loss of Source Range Nuclear Instrumentation: Startup termination on source-range loss | 3.2/3.6 | 14 |
| 000033 Loss of Intermediate Range NI / 7 | | | | | | | | | |
| 000036 (BW/A08) Fuel Handling Accident / 8 | | | | | | | | | |
| 000037 Steam Generator Tube Leak / 3 | | | | | | | | | |
| 000051 Loss of Condenser Vacuum / 4 | | | | | | | | | |
| 000059 Accidental Liquid Radwaste Rel. / 9 | | | | | | | | | |
| 000060 Accidental Gaseous Radwaste Rel. / 9 | | | | | | | | | |
| 000061 ARM System Alarms / 7 | | | | | X | | AA2.03 Ability to determine and interpret the following as they apply to Area Radiation Monitoring (ARM) System Alarms: Setpoints for alert and high alarms | 3.0/3.3 | 15 |
| 000067 Plant Fire On-site / 8 | | | | | | | | | |
| 000068 (BW/A06) Control Room Evac. / 8 | | | | | | | | | |
| 000069 (W/E14) Loss of CTMT Integrity / 5 | | | | | | | | | |
| 000074 (W/E06&E07) Inad. Core Cooling / 4 | | | | | | | | | |
| 000076 High Reactor Coolant Activity / 9 | | | | X | | | AA1.04 Ability to operate and / or monitor the following as they apply to the High Reactor Coolant Activity: Failed fuel-monitoring equipment | 3.2/3.4 | 16 |
| W/E01 & E02 Rediagnosis & SI Termination / 3 | | | | | | | | | |
| W/E13 Steam Generator Over-pressure / 4 | | | | | | | | | |
| W/E15 Containment Flooding / 5 | | | | | | | | | |
| W/E16 High Containment Radiation / 9 | | | | | | | | | |
| BW/A01 Plant Runback / 1 | | | | | | | | | |
| BW/A02&A03 Loss of NNI-X/Y / 7 | | X | | | | | AK2.1 Knowledge of the interrelations between the (Loss of NNI-X/Y) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features. | 3.8/4.0 | 17 |
| BW/A04 Turbine Trip / 4 | | | | | | | | | |
| BW/A05 Emergency Diesel Actuation / 6 | | | | | X | | AA2.1 Ability to determine and interpret the following as they apply to (Emergency Diesel Actuation) Facility conditions and selection of appropriate procedures during abnormal and emergency operations. | 3.5/4.2 | 48 |

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|---|---|---|---|---|---|---|--|--|---------|----|
| BW/A07 Flooding / 8 | | | | | | | | | | |
| BW/E03 Inadequate Subcooling Margin / 4 | | | X | | | | | EK3.1 Knowledge of the reasons for the following responses as they apply to (Inadequate Subcooling Margin) Facility operating characteristics during transient conditions, including coolant chemistry and the effects of temperature, pressure, and reactivity changes and operating limitations and reasons for these operating characteristics. | 3.2/3.8 | 51 |
| BW/E08; W/E03 LOCA Cooldown - Depress. / 4 | | | | | | | | | | |
| BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4 | | | | | | | | | | |
| BW/E13&E14 EOP Rules and Enclosures | | | | | | | | | | |
| CE/A11; W/E08 RCS Overcooling - PTS / 4 | | | | | | | | | | |
| CE/A16 Excess RCS Leakage / 2 | | | | | | | | | | |
| CE/E09 Functional Recovery | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| K/A Category Point Totals: | 1 | 1 | 2 | 1 | 3 | 1 | | Group Point Total: | | 9 |

| ES-401 | | PWR Examination Outline Plant Systems - Tier 2/Group 1 (RO / SRO) | | | | | | | | | | | Form ES-401-2 | |
|--|--------|--|--------|--------|--------|--------|--------|--------|--------|--------|----|--|------------------------|--------------|
| System # / Name | K 1 | K 2 | K 3 | K 4 | K 5 | K 6 | A 1 | A 2 | A 3 | A 4 | G* | K/A Topic(s) | IR | # |
| 003 Reactor Coolant Pump | | | | | X | | | | | | | K5.03 Knowledge of the operational implications of the following concepts as they apply to RCPS: Effects of RCP shutdown on T-ave., including the reason for unreliability of T-ave. in the shutdown loop. | 3.1/3.5 | 58 |
| 004 Chemical and Volume Control | | | | | | | X | | | | | A1.06 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the CVCS controls including: VCT level | 3.0/3.2 | 18 |
| 005 Residual Heat Removal | | | | | X | | | | | X | | K5.01 Knowledge of the operational implications of the following concepts as they apply the RHRS: Nil ductility transition temperature (brittle fracture) A4.02: Ability to manually operate and/or monitor in the control room: Heat exchanger bypass flow control. | 2.6/2.9 3.4/3.1 | 19 59 |
| 006 Emergency Core Cooling | | X | | | | | | | | | | K2.02 Knowledge of bus power supplies to the following: ESFAS-operated valves. | 3.6/3.8 | 68 |
| 007 Pressurizer Relief/Quench Tank | | | | | | | | | | | X | 2.1.23 Ability to perform specific system and integrated plant procedures during all modes of plant operation. | 4.3/4.4 | 20 |
| 008 Component Cooling Water | | | | | | | | | | X | | A4.09 Ability to manually operate and/or monitor in the control room: CCW temperature control valve | 30/4.9 | 21 |
| 010 Pressurizer Pressure Control | | | | | | X | | X | | | | K6.01 Knowledge of the effect of a loss or malfunction of the following will have on the PZR PCS: Pressure detection systems A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the PZR PCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Heater failures | 2.7/3.1 3.3/3.6 | 50 22 |
| 012 Reactor Protection | | | | | | X | | | | | | K6.02 Knowledge of the effect of a loss or malfunction of the following will have on RPS: Redundant channels | 2.9/3.1 | 52 |
| 013 Engineered Safety Features Actuation | X | | | | | | | | | | | K1.01 Knowledge of the physical connections and/or cause effect relationships between the ESFAS and the following systems: Initiation signals for ESF circuit logic | 4.2/4.4 | 23 |

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|-----------------------------------|---|--|--|---|--|---|--|---|--|---|--|--|---------|----|
| 022 Containment Cooling | | | | X | | | | X | | | | K4.04 Knowledge of CCS design feature(s) and/or interlock(s) which provide for the following: Cooling of containment penetrations. | 2.5/3.0 | 53 |
| | | | | | | | | | | | | A2.03 Ability to (a) predict the impacts of the following malfunctions or operations on the CCS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Fan motor thermal overload/high-speed operation | 2.6/3.0 | 24 |
| 025 Ice Condenser | | | | | | | | | | | | | | |
| 026 Containment Spray | | | | X | | | | | | | | K3.01 Knowledge of the effect that a loss or malfunction of the CSS will have on the following: CCS | 3.9/4.1 | 65 |
| 039 Main and Reheat Steam | X | | | | | X | | | | | | K1.08: Knowledge of the physical connections and/or cause-effect relationships between the MRSS and the following systems: MFW | 2.7/2.9 | 61 |
| | | | | | | | | | | | | K5.08 Knowledge of the operational implications of the following concepts as they apply to the MRSS: Effect of steam removal on reactivity | 3.6/3.6 | 27 |
| 059 Main Feedwater | X | | | | | | | | | | | K1.02 Knowledge of the physical connections and/or cause effect relationships between the MFW and the following systems: AFW system | 3.4/3.4 | 26 |
| 061 Auxiliary/Emergency Feedwater | | | | X | | | | X | | | | K3.01 Knowledge of the effect that a loss or malfunction of the AFW will have on the following: RCS | 4.4/4.6 | 28 |
| | | | | | | | | | | | | A3.03 Ability to monitor automatic operation of the AFW, including: AFW S/G level control on automatic start | 3.9/3.9 | 62 |
| 062 AC Electrical Distribution | | | | X | | | | | | | | K4.07 Knowledge of ac distribution system design feature(s) and/or interlock(s) which provide for the following: One-line diagram of 4kV to 480V distribution, including sources of normal and alternative power | 2.7/3.1 | 54 |
| 063 DC Electrical Distribution | | | | X | | | | X | | | | K4.02 Knowledge of DC electrical system design feature(s) and/or interlock(s) which provide for the following: Breaker interlocks, permissives, bypasses and cross-ties. | 2.9/3.2 | 30 |
| | | | | | | | | | | | | A3.01 Ability to monitor automatic operation of the DC electrical system, including: Meters, annunciators, dials, recorders, and indicating lights | 2.7/3.1 | 29 |
| 064 Emergency Diesel Generator | | | | X | | | | X | | | | K2.02 Knowledge of the physical connections and/or cause effect relationships between the ED/G system and the following systems: Fuel oil pumps | 2.8/3.1 | 31 |
| | | | | | | | | | | | | A3.03 Ability to monitor automatic operation of the ED/G system, including: Indicating lights, meters, and recorders | 3.4/3.3 | 32 |
| 073 Process Radiation Monitoring | | | | | | | | | | X | | 2.1.28 Knowledge of the purpose and function of major system components and controls. | 4.1/4.1 | 55 |

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|----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|--|---------|----|
| 076 Service Water | | | | | | | | | X | | | | A2.01 Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the SWS controls including: Loss of SWS | 3.5/3.7 | 33 |
| 078 Instrument Air | | | | | | | | | X | | | | K1.04 Knowledge of the physical connections and/or cause-effect relationships between the IAS and the following systems: Cooling water to compressor | 2.6/2.9 | 34 |
| 103 Containment | | | | | | | | | | | | X | 2.4.6: Knowledge of EOP mitigation strategies. | 3.7/4.7 | 57 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| K/A Category Point Totals: | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | Group Point Total: 28 | | 28 |

| | | | | | | | | | | | | | | | | |
|----------------------------|---|---|---|---|---|---|---|---|---|---|---|--|--------------------|---|---------|----|
| 075 Circulating Water | | | | | | | | | | | | | X | 2.4.21: Knowledge of the parameters and logic used to assess the status of safety functions, such as reactivity control, core cooling and heat removal, reactor coolant system integrity, containment conditions, radioactivity release control, etc. | 3.8/4.5 | 63 |
| 079 Station Air | | | | X | | | | | | | | | | K4.01: Knowledge of SAS design feature(s) and/or interlock(s) which provide for the following: Cross-Connect with IAS | 2.9/3.2 | 39 |
| 086 Fire Protection | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | |
| K/A Category Point Totals: | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 1 | 1 | 2 | | Group Point Total: | | 10 | 10 |

| Facility: | | Date of Exam: | | | | |
|---|----------|---|---------|----|----------|---|
| Category | K/A # | Topic | RO | | SRO-Only | |
| | | | IR | # | IR | # |
| 1. Conduct of Operations | 2.1.25 | Ability to interpret reference materials, such as graphs, curves, tables, etc. | 3.9/4.2 | 40 | | |
| | 2.1.42 | Knowledge of new and spent fuel movement procedures. | 2.5/3.4 | 70 | | |
| | 2.1. | | | | | |
| | 2.1. | | | | | |
| | 2.1. | | | | | |
| | 2.1. | | | | | |
| | Subtotal | | | | | |
| 2. Equipment Control | 2.2.12 | Knowledge of surveillance procedures. | 3.7/4.1 | 72 | | |
| | 2.2.38 | Knowledge of conditions and limitations in the facility license. | 3.6/4.5 | 71 | | |
| | 2.2.39 | Knowledge of less than or equal to one hour Technical Specifications action statements for systems. | 3.9/4.5 | 41 | | |
| | 2.2. | | | | | |
| | 2.2. | | | | | |
| | 2.2. | | | | | |
| | Subtotal | | | | | |
| 3. Radiation Control | 2.3.4 | Knowledge of radiation exposure limits under normal or emergency conditions. | 3.2/3.7 | 42 | | |
| | 2.3.11 | Ability to control radiation releases. | 3.8/4.3 | 43 | | |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | Subtotal | | | | | |
| 4. Emergency Procedures / Plan | 2.4.9 | Knowledge of low power/shutdown implications in accident (e.g., loss of coolant [accident or loss of residual heat removal) mitigation strategies. | 3.8/4.2 | 74 | | |
| | 2.4.16 | Knowledge of EOP implementation hierarchy and coordination with other support procedures or guidelines such as, operating procedures, abnormal operating procedures, and severe accident management guidelines. | 3.5/4.4 | 44 | | |
| | 2.4.35 | Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. | 3.8/4.0 | 45 | | |
| | 2.4. | | | | | |
| | 2.4. | | | | | |
| | 2.4. | | | | | |
| | Subtotal | | | | | |
| Tier 3 Point Total | | | | 10 | | 7 |

PWR Examination Outline

Form ES-401-2

| Facility: Three Mile Island | | | | | | | | | | | | | | Date of Exam: 06/26/17 | | | |
|---|-------------|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-------|------------------------|----|-------|--|
| Tier | Group | RO K/A Category Points | | | | | | | | | | | | SRO-Only Points | | | |
| | | K 1 | K 2 | K 3 | K 4 | K 5 | K 6 | A 1 | A 2 | A 3 | A 4 | G* | Total | A2 | G* | Total | |
| 1. Emergency & Abnormal Plant Evolutions | 1 | | | | | | | | | | | | 18 | 4 | 2 | 6 | |
| | 2 | | | | | | | | | | | | 9 | 1 | 3 | 4 | |
| | Tier Totals | | | | | | | | | | | | 27 | 5 | 5 | 10 | |
| 2. Plant Systems | 1 | | | | | | | | | | | | 28 | 2 | 3 | 5 | |
| | 2 | | | | | | | | | | | | 10 | 2 | 1 | 3 | |
| | Tier Totals | | | | | | | | | | | | 38 | 4 | 4 | 8 | |
| 3. Generic Knowledge and Abilities Categories | | | | | 1 | 2 | 3 | 4 | 10 | 1 | 2 | 3 | 4 | 7 | | | |

Note:

- Ensure that at least two topics from every applicable K/A category are sampled within each tier of the RO and SRO-only outlines (i.e., except for one category in Tier 3 of the SRO-only outline, the "Tier Totals" in each K/A category shall not be less than two). (One Tier 3 Radiation Control K/A is allowed if the K/A is replaced by a K/A from another Tier 3 Category).
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- Select topics from as many systems and evolutions as possible; sample every system or evolution in the group before selecting a second topic for any system or evolution.
- Absent a plant-specific priority, only those K/As having an importance rating (IR) of 2.5 or higher shall be selected. Use the RO and SRO ratings for the RO and SRO-only portions, respectively.
- Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.
- The generic (G) K/As in Tiers 1 and 2 shall be selected from Section 2 of the K/A Catalog, but the topics must be relevant to the applicable evolution or system. Refer to Section D.1.b of ES-401 for the applicable K/As.
- On the following pages, enter the K/A numbers, a brief description of each topic, the topics' importance ratings (IRs) for the applicable license level, and the point totals (#) for each system and category. Enter the group and tier totals for each category in the table above; if fuel handling equipment is sampled in a category other than Category A2 or G* on the SRO-only exam, enter it on the left side of Column A2 for Tier 2, Group 2 (Note #1 does not apply). Use duplicate pages for RO and SRO-only exams.
- For Tier 3, select topics from Section 2 of the K/A catalog, and enter the K/A numbers, descriptions, IRs, and point totals (#) on Form ES-401-3. Limit SRO selections to K/As that are linked to 10 CFR 55.43.

G* Generic K/As

| ES-401 | | PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO) | | | | | | Form ES-401-2 | |
|---|--------|--|--------|--------|--------|----|---|---------------|----|
| E/APE # / Name / Safety Function | K 1 | K 2 | K 3 | A 1 | A 2 | G* | K/A Topic(s) | IR | # |
| 000007 (BW/E02&E10; CE/E02) Reactor Trip - Stabilization - Recovery / 1 | | | | | | | | | |
| 000008 Pressurizer Vapor Space Accident / 3 | | | | | X | | AA2.20 Ability to determine and interpret the following as they apply to the Pressurizer Vapor Space Accident: PZR level indicators. | 3.6 | 76 |
| 000009 Small Break LOCA / 3 | | | | | | X | 2.4.31 Knowledge of annunciator alarms, indications, or response procedures. | 4.1 | 77 |
| 000011 Large Break LOCA / 3 | | | | | | | | | |
| 000015/17 RCP Malfunctions / 4 | | | | | | | | | |
| 000022 Loss of Rx Coolant Makeup / 2 | | | | | | | | | |
| 000025 Loss of RHR System / 4 | | | | | | | | | |
| 000026 Loss of Component Cooling Water / 8 | | | | | X | | AA2.02: Ability to determine and interpret the following as they apply to the Loss of Component Cooling Water: The cause of possible CCW loss | 3.6 | 78 |
| 000027 Pressurizer Pressure Control System Malfunction / 3 | | | | | | | | | |
| 000029 ATWS / 1 | | | | | | | | | |
| 000038 Steam Gen. Tube Rupture / 3 | | | | | | | | | |
| 000040 (BW/E05; CE/E05; W/E12) Steam Line Rupture - Excessive Heat Transfer / 4 | | | | | | | | | |
| 000054 (CE/E06) Loss of Main Feedwater / 4 | | | | | X | | AA2.01 Ability to determine and interpret the following as they apply to the Loss of Main Feedwater (MFW): Occurrence of reactor and/or turbine trip | 4.4 | 79 |
| 000055 Station Blackout / 6 | | | | | | | | | |
| 000056 Loss of Off-site Power / 6 | | | | | | | | | |
| 000057 Loss of Vital AC Inst. Bus / 6 | | | | | | | | | |
| 000058 Loss of DC Power / 6 | | | | | X | | AA2.03 Ability to determine and interpret the following as they apply to the Loss of DC Power: DC loads lost; impact on ability to operate and monitor plant systems | 3.9 | 80 |
| 000062 Loss of Nuclear Svc Water / 4 | | | | | | | | | |
| 000065 Loss of Instrument Air / 8 | | | | | | | | | |
| W/E04 LOCA Outside Containment / 3 | | | | | | | | | |
| W/E11 Loss of Emergency Coolant Recirc. / 4 | | | | | | | | | |
| BW/E04; W/E05 Inadequate Heat Transfer - Loss of Secondary Heat Sink / 4 | | | | | | X | 2.4.9: Ability to interpret control room indications to verify the status and operation of a system, and understand how operator actions and directives affect plant and system conditions. | 4.1 | 81 |
| 000077 Generator Voltage and Electric Grid Disturbances / 6 | | | | | | | | | |
| K/A Category Totals: | | | | | 4 | 2 | Group Point Total: | | 6 |

| ES-401 | | PWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO) | | | | | | Form ES-401-2 | |
|--|--------|--|--------|--------|--------|----|--|---------------|----|
| E/APE # / Name / Safety Function | K 1 | K 2 | K 3 | A 1 | A 2 | G* | K/A Topic(s) | IR | # |
| 000001 Continuous Rod Withdrawal / 1 | | | | | | | | | |
| 000003 Dropped Control Rod / 1 | | | | | | | | | |
| 000005 Inoperable/Stuck Control Rod / 1 | | | | | | | | | |
| 000024 Emergency Boration / 1 | | | | | | | | | |
| 000028 Pressurizer Level Malfunction / 2 | | | | | | | | | |
| 000032 Loss of Source Range NI / 7 | | | | | | | | | |
| 000033 Loss of Intermediate Range NI / 7 | | | | | | | | | |
| 000036 (BW/A08) Fuel Handling Accident / 8 | | | | | | | | | |
| 000037 Steam Generator Tube Leak / 3 | | | | | | | | | |
| 000051 Loss of Condenser Vacuum / 4 | | | | | | | | | |
| 000059 Accidental Liquid Radwaste Rel. / 9 | | | | | | | | | |
| 000060 Accidental Gaseous Radwaste Rel. / 9 | | | | | | | | | |
| 000061 ARM System Alarms / 7 | | | | | | | | | |
| 000067 Plant Fire On-site / 8 | | | | | | | | | |
| 000068 (BW/A06) Control Room Evac. / 8 | | | | | | | | | |
| 000069 (W/E14) Loss of CTMT Integrity / 5 | | | | | | | | | |
| 000074 (W/E06&E07) Inad. Core Cooling / 4 | | | | | | | | | |
| 000076 High Reactor Coolant Activity / 9 | | | | | | X | 2.2.38 Knowledge of conditions and limitations in the facility license. | 4.5 | 83 |
| W/E01 & E02 Rediagnosis & SI Termination / 3 | | | | | | | | | |
| W/E13 Steam Generator Over-pressure / 4 | | | | | | | | | |
| W/E15 Containment Flooding / 5 | | | | | | | | | |
| W/E16 High Containment Radiation / 9 | | | | | | | | | |
| BW/A01 Plant Runback / 1 | | | | | | | | | |
| BW/A02&A03 Loss of NNI-X/Y / 7 | | | | | | | | | |
| BW/A04 Turbine Trip / 4 | | | | | | | | | |
| BW/A05 Emergency Diesel Actuation / 6 | | | | | | | | | |
| BW/A07 Flooding / 8 | | | | | | | | | |
| BW/E03 Inadequate Subcooling Margin / 4 | | | | | X | | EA2.1 Ability to determine and interpret the following as they apply to the (Inadequate Subcooling Margin) Facility conditions and selection of appropriate procedures during abnormal and emergency operations. | 4.0 | 84 |
| BW/E08; W/E03 LOCA Cooldown - Depress. / 4 | | | | | | X | 2.4.18: Knowledge of the specific bases for EOPs. | 4.0 | 82 |
| BW/E09; CE/A13; W/E09&E10 Natural Circ. / 4 | | | | | | | | | |
| BW/E13&E14 EOP Rules and Enclosures | | | | | | X | 2.2.44: Ability to recognize system parameters that are entry-level conditions for technical specifications. | 4.5 | 84 |
| CE/A11; W/E08 RCS Overcooling - PTS / 4 | | | | | | | | | |
| CE/A16 Excess RCS Leakage / 2 | | | | | | | | | |
| CE/E09 Functional Recovery | | | | | | | | | |
| K/A Category Point Totals: | | | | | 1 | 3 | Group Point Total: | | 4 |

| ES-401 | | PWR Examination Outline Plant Systems - Tier 2/Group 1 (RO / SRO) | | | | | | | | | | | | Form ES-401-2 | |
|--|--------|--|--------|--------|--------|--------|--------|--------|--------|--------|----|---|-----|---------------|--|
| System # / Name | K 1 | K 2 | K 3 | K 4 | K 5 | K 6 | A 1 | A 2 | A 3 | A 4 | G* | K/A Topic(s) | IR | # | |
| 003 Reactor Coolant Pump | | | | | | | | | | | | | | | |
| 004 Chemical and Volume Control | | | | | | | | | | | | | | | |
| 005 Residual Heat Removal | | | | | | | | | | | | | | | |
| 006 Emergency Core Cooling | | | | | | | | | | | X | 2.4.9: Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies. | 4.2 | 86 | |
| 007 Pressurizer Relief/Quench Tank | | | | | | | | | | | | | | | |
| 008 Component Cooling Water | | | | | | | | | | | | | | | |
| 010 Pressurizer Pressure Control | | | | | | | | | | | | | | | |
| 012 Reactor Protection | | | | | | | | | | | | | | | |
| 013 Engineered Safety Features Actuation | | | | | | | | | | | X | 2.4.35 Knowledge of local auxiliary operator tasks during an emergency and the resultant operational effects. | 4.0 | 87 | |
| 022 Containment Cooling | | | | | | | | | | | | | | | |
| 025 Ice Condenser | | | | | | | | | | | | | | | |
| 026 Containment Spray | | | | | | | | | | | | | | | |
| 039 Main and Reheat Steam | | | | | | | | | | | | | | | |
| 059 Main Feedwater | | | | | | | | | | | | | | | |
| 061 Auxiliary/Emergency Feedwater | | | | | | | | | | | X | 2.4.18 Knowledge of the specific bases for EOPs. | 4.0 | 88 | |
| 062 AC Electrical Distribution | | | | | | | | | | | | | | | |
| 063 DC Electrical Distribution | | | | | | | | | | | | | | | |
| 064 Emergency Diesel Generator | | | | | | | | | | | | | | | |
| 073 Process Radiation Monitoring | | | | | | | | | | | | | | | |
| 076 Service Water | | | | | | | | | | | | | | | |
| 078 Instrument Air | | | | | | | | X | | | | A2.01 Ability to (a) predict the impacts of the following malfunctions or operations on the IAS and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations Ability to (a) predict the impacts of the following malfunctions or operations on the IAS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Air dryer and filter malfunctions | 2.9 | 89 | |
| 103 Containment | | | | | | | | X | | | | A2.04 Containment evacuation (including recognition of the alarm) | 3.6 | 90 | |
| K/A Category Point Totals: | | | | | | | | 2 | | | 3 | Group Point Total: | | 5 | |

| ES-401 | | PWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO) | | | | | | | | | | Form ES-401-2 | | |
|---|--------|--|--------|--------|--------|--------|--------|--------|--------|--------|----|---|-----|------|
| System # / Name | K 1 | K 2 | K 3 | K 4 | K 5 | K 6 | A 1 | A 2 | A 3 | A 4 | G* | K/A Topic(s) | IR | # |
| 001 Control Rod Drive | | | | | | | | | | | | | | |
| 002 Reactor Coolant | | | | | | | | | | | | | | |
| 011 Pressurizer Level Control | | | | | | | | | | | | | | |
| 014 Rod Position Indication | | | | | | | | | | | | | | |
| 015 Nuclear Instrumentation | | | | | | | | | | | | | | |
| 016 Non-Nuclear Instrumentation | | | | | | | | | | | | | | |
| 017 In-Core Temperature Monitor | | | | | | | | | | | X | 2.4.3 Ability to identify post-accident instrumentation. | 3.9 | 91 |
| 027 Containment Iodine Removal | | | | | | | | | | | | | | |
| 028 Hydrogen Recombiner and Purge Control | | | | | | | | | | | | | | |
| 029 Containment Purge | | | | | | | | | | | | | | |
| 033 Spent Fuel Pool Cooling | | | | | | | | | | | | | | |
| 034 Fuel Handling Equipment | | | | | | | | | | | | | | |
| 035 Steam Generator | | | | | | | | | | | | | | |
| 041 Steam Dump/Turbine Bypass Control | | | | | | | | | | | | | | |
| 045 Main Turbine Generator | | | | | | | | | | | | | | |
| 055 Condenser Air Removal | | | | | | | | | | | | | | |
| 056 Condensate | | | | | | | | X | | | | A2.04 Ability to (a) predict the impacts of the following malfunctions or operations on the Condensate System; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of condensate pumps | 2.6 | 92 |
| 068 Liquid Radwaste | | | | | | | | X | | | | A2.04 Ability to (a) predict the impacts of the following malfunctions or operations on the Liquid Radwaste System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: | 3.3 | 93 |
| 071 Waste Gas Disposal | | | | | | | | | | | | | | |
| 072 Area Radiation Monitoring | | | | | | | | | | | | | | |
| 075 Circulating Water | | | | | | | | | | | | | | |
| 079 Station Air | | | | | | | | | | | | | | |
| 086 Fire Protection | | | | | | | | | | | | | | |
| K/A Category Point Totals: | | | | | | | | 2 | | | 1 | Group Point Total: | | 10/3 |

| Facility: | | Date of Exam: | | | | |
|---|----------|---|----|----|----------|-----|
| Category | K/A # | Topic | RO | | SRO-Only | |
| | | | IR | # | IR | # |
| 1. Conduct of Operations | 2.1.32 | Ability to explain and apply system limits and precautions. | | | 4.0 | 94 |
| | 2.1.42 | Knowledge of new and spent fuel movement procedures. | | | 3.4 | 95 |
| | 2.1.4 | | | | | |
| | 2.1. | | | | | |
| | 2.1. | | | | | |
| | 2.1. | | | | | |
| | Subtotal | | | | | |
| 2. Equipment Control | 2.2.7 | Knowledge of the process for conducting special or infrequent tests. | | | 3.6 | 96 |
| | 2.2.21 | Knowledge of pre- and post-maintenance operability requirements. | | | 4.1 | 97 |
| | 2.2. | | | | | |
| | 2.2. | | | | | |
| | 2.2. | | | | | |
| | 2.2. | | | | | |
| | Subtotal | | | | | |
| 3. Radiation Control | 2.3.6 | Ability to approve release permits. | | | 3.8 | 98 |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | 2.3. | | | | | |
| | Subtotal | | | | | |
| 4. Emergency Procedures / Plan | 2.4.34 | Knowledge of RO tasks performed outside the main control room during an emergency and the resultant operational effects | | | 4.1 | 99 |
| | 2.4.45 | Ability to prioritize and interpret the significance of each annunciator or alarm. | | | 4.3 | 100 |
| | 2.4. | | | | | |
| | 2.4. | | | | | |
| | 2.4. | | | | | |
| | 2.4. | | | | | |
| | Subtotal | | | | | |
| Tier 3 Point Total | | | | 10 | | 7 |

Facility: Three Mile IslandDate of Examination: 6/26/17Examination Level: RO ☐ SRO ☒Operating Test Number: TMI-2017-1

| Administrative Topic (See Note) | Type Code* | Describe activity to be performed |
|------------------------------------|---------------|---|
| Conduct of Operations | R, P, D | Maintain Minimum Shift Staffing, Control Overtime 2.1.5 From 14-01 NRC Exam |
| Conduct of Operations | R, D | Perform an estimated critical rod position calculation 2.1.43 |
| Equipment Control | R, D | Use Station Drawing to Predict Impact of Component Failure and Evaluate Technical Specification Implications 2.2.41 |
| Radiation Control | R, D | Review RB Entry Survey Log 2.3.13 |
| Emergency Plan | S, M | EAL and PAR 2.4.44 |

NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics (which would require all five items).

* Type Codes & Criteria:

- (C)ontrol room, (S)imulator, or Class(R)oom
- (D)irect from bank (≤ 3 for ROs; ≤ 4 for SROs & RO retakes)
- (N)ew or (M)odified from bank (≥ 1)
- (P)revious 2 exams (≤ 1 ; randomly selected)

SA1-1 – The examinee will have to identify the required actions to restore minimum staffing and then select personnel to control overtime.

SA1-2 – The examinee will have to independently perform, and approve an estimated critical position.

SA2 – The examinee will have to use station drawings to determine that the Emergency Diesel Generator is inoperable and declare the correct technical specification time clock.

SA3 – The examinee will have to identify all the faults in the RP Entry Survey Log.

SA4 – The examinee will have to determine the EAL and make a PAR in accordance with the facility Emergency Plan.

Facility: Three Mile Island
 Exam Level: RO ☐ SRO-I ☒ SRO-U ☐

Date of Examination: 06/26/17
 Operating Test No.: TMI-2017-1

Control Room Systems: *8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

| System / JPM Title | Type Code* | Safety Function |
|---|---------------------------------|-----------------|
| a. Makeup System / Emergency Borate Using the BAMT as the Source – Alternate Path - 004 A2.14 | A, D, S | 1 |
| b. Reactor Coolant System / Restoration of letdown flow following high temperature closure of MU-V-3 - 002 A1.02 | D, S | 2 |
| c. Emergency Core Cooling System / Respond to inadvertent ES actuation – Alternate Path - 006 A2.13 | A, EN, M, S | 3 |
| d. Residual Heat Removal System / Transfer of Reactor Building Sump Recirculation - Alternate Path – 005 A2.04 | A, D, L, S | 4P |
| e. Containment Cooling System / Perform Emergency Operations of Reactor Building Emergency Cooling water - Alternate Path - 022 A4.04 | A, M, S | 5 |
| f. A.C Electrical Distribution / Transfer BOP Busses from 1B to 1A Aux Transformer – 062 A4.01 | M, S | 6 |
| g. N/A for SRO's | N/A | N/A |
| h. Radiation Monitoring System / Respond IAW OP-TM-MAP-C0101 Alarm Response with failure – Alternate Path – 072 A3.01 | A, D, P, S | 7 |
| In-Plant Systems * (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U) | | |
| i. Main Steam System / Locally / Manually Operate the Turbine Bypass Valves (MS-V-3A-F) 041 A4.08 | D | 4S |
| j. Nuclear Service Closed Cooling Water / Emergency Makeup to Nuclear Service Closed Cooling Surge Tank (NS-T-1) - 008A4.07 | D, E | 8 |
| k. Waste Gas System / Take Corrective Action for an Unauthorized Waste Gas Release – 071G2.1.30 | D, R | 9 |
| * All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room. | | |
| * Type Codes | Criteria for RO / SRO-I / SRO-U | |

| | |
|--|--|
| (A)lternate path | 4-6 / 4-6 / 2-3 |
| (C)ontrol room | |
| (D)irect from bank | ≤ 9 / ≤ 8 / ≤ 4 |
| (E)mergency or abnormal in-plant | ≥ 1 / ≥ 1 / ≥ 1 |
| (EN)gineered safety feature | ≥ 1 / ≥ 1 / ≥ 1 (control room system) |
| (L)ow-Power / Shutdown | ≥ 1 / ≥ 1 / ≥ 1 |
| (N)ew or (M)odified from bank including 1(A) | ≥ 2 / ≥ 2 / ≥ 1 |
| (P)revious 2 exams | ≤ 3 / ≤ 3 / ≤ 2 (randomly selected) |
| (R)CA | ≥ 1 / ≥ 1 / ≥ 1 |
| (S)imulator | |

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JPM A: Emergency Borate Using the BAMT as the Source – Alternate Path - In this JPM the examinee will be directed to perform OP-TM-EOP-010, Rule 5 for emergency boration. Due to malfunctions, the examinee will have to initiate emergency boration using Guide 1.

JPM B: Restoration of Letdown Flow Following Temperature Closure of MU-V-3 – In this JPM the examinee will show the ability to restore letdown while maintaining normal pressurizer level and makeup tank bands.

JPM C: Respond to an Inadvertent ESAS Actuation-Alternate Path – In this JPM the examinee will show the ability to perform the IMA's of OP-TM-AOP-046, INADVERTENT ESAS ACTUATION. The 'B' 500 psig ES signal will not be able to be cleared so the examinee will end up having to throttle open MU-V-16B to ensure proper makeup pump flow.

JPM D: Transfer of Reactor Building Sump Recirculation - Alternate Path – In this JPM the examinee will demonstrate the ability to throttle LPI to within limits after a sump recirculation suction valve fails to open after a LOCA.

JPM E: Perform Emergency Operations of Reactor Building Emergency Cooling Water – Alternate Path – In this JPM the examinee will be directed to initiate Reactor Building Emergency Cooling. This JPM is modified so that RR-V-1B does not open and RR-P-1B must be secured.

JPM F: Transfer BOP Busses from 1B to 1A Aux Transformer – In this JPM the examinee will demonstrate the ability to transfer the 1C 4160V Bus from the 1B Aux Transformer to the 1A Aux Transformer.

JPM H: Respond IAW OP-TM-MAP-C0101 Alarm Response with Failure – Alternate Path – In this JPM, the examinee will have to put the control tower on emergency recirculation. AH-E-18B will trip so the examinee will have to start the opposite train.

JPM I: Manually/Locally operate the turbine bypass valves (MS-V-3A-F) – In this JPM the examinee will take local manual control of MS-V-3C.

JPM J: Emergency Makeup to Nuclear Service Closed Cooling Surge Tank (NS-T-1) – In this JPM the examinee will have to do an emergency fill of the nuclear closed cooling water surge tank.

| | | | |
|---|---------------------------------|---------------------------------------|--|
| Facility: <u>Three Mile Island</u> | | Date of Examination: <u>06/26/17</u> | |
| Exam Level: RO <input type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input type="checkbox"/> | | Operating Test No.: <u>TMI-2017-1</u> | |
| Control Room Systems: *8 for RO; 7 for SRO-I; 2 or 3 for SRO-U | | | |
| System / JPM Title | Type Code* | Safety Function | |
| a. Emergency Core Cooling System / Emergency Borate Using the BAMT as the Source – Alternate Path - 004 A2.14 | A, D, S | 1 | |
| b. Makeup System / Removing Makeup Pump 1B from Service – 004 A4.11 | D, S | 2 | |
| c. Emergency Core Cooling System / Respond to inadvertant ES actuation – Alternate Path - 006 A2.13 | A, EN, M, S | 3 | |
| d. Residual Heat Removal System / Transfer of Reactor Building Sump Recirculation - Alternate Path – 005 A2.04 | A, D, L, S | 4P | |
| e. Containment Cooling System / Perform Emergency Operations of Reactor Building Emergency Cooling water - Alternate Path - 022 A4.04 | A, M, S | 5 | |
| f. A.C Electrical Distribution / Transfer BOP Busses from 1B to 1A Aux Transformer – 062 A4.01 | M, S | 6 | |
| g. N/A for SRO's | N/A | N/A | |
| h. Radiation Monitoring System / Respond IAW OP-TM-MAP-C0101 Alarm Response with failure – Alternate Path – 072 A3.01 | A, D, P, S | 7 | |
| In-Plant Systems * (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U) | | | |
| i. Main Steam System / Locally / Manually Operate the Turbine Bypass Valves (MS-V-3A-F) 041 A4.08 | D | 4S | |
| j. Nuclear Service Closed Cooling Water / Emergency Makeup to Nuclear Service Closed Cooling Surge Tank (NS-T-1) - 008A4.07 | D, E | 8 | |
| k. Waste Gas System / Take Corrective Action for an Unauthorized Waste Gas Release – 071G2.1.30 | D, R | 9 | |
| * All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room. | | | |
| * Type Codes | Criteria for RO / SRO-I / SRO-U | | |

| | |
|--|--|
| (A)lternate path | 4-6 / 4-6 / 2-3 |
| (C)ontrol room | |
| (D)irect from bank | ≤ 9 / ≤ 8 / ≤ 4 |
| (E)mergency or abnormal in-plant | ≥ 1 / ≥ 1 / ≥ 1 |
| (EN)gineered safety feature | ≥ 1 / ≥ 1 / ≥ 1 (control room system) |
| (L)ow-Power / Shutdown | ≥ 1 / ≥ 1 / ≥ 1 |
| (N)ew or (M)odified from bank including 1(A) | ≥ 2 / ≥ 2 / ≥ 1 |
| (P)revious 2 exams | ≤ 3 / ≤ 3 / ≤ 2 (randomly selected) |
| (R)CA | ≥ 1 / ≥ 1 / ≥ 1 |
| (S)imulator | |

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JPM A: Emergency Borate Using the BAMT as the Source – Alternate Path – In this JPM the examinee will be directed to perform OP-TM-EOP-010, Rule 5 for emergency boration. Due to malfunctions, the examinee will have to initiate emergency boration using Guide 1.

JPM B: Removing Makeup Pump 1B from Service – In this JPM the examinee will show the ability remove the makeup pump supplying RCS makeup and Seal injection from service while maintaining plant stability.

JPM C: Respond to an Inadvertent ESAS Actuation-Alternate Path – In this JPM the examinee will show the ability to perform the IMA's of OP-TM-AOP-046, INADVERTENT ESAS ACTUATION. The 'B' 500 psig ES signal will not be able to be cleared so the examinee will end up having to throttle open MU-V-16B to ensure proper makeup pump flow.

JPM D: Transfer of Reactor Building Sump Recirculation - Alternate Path – In this JPM the examinee will demonstrate the ability to throttle LPI to within limits after a sump recirculation suction valve fails to open after a LOCA.

JPM E: Perform Emergency Operations of Reactor Building Emergency Cooling Water – Alternate Path – In this JPM the examinee will be directed to initiate Reactor Building Emergency Cooling. This JPM is modified so that RR-V-1B does not open and RR-P-1B must be secured.

JPM F: Transfer BOP Busses from 1B to 1A Aux Transformer – In this JPM the examinee will demonstrate the ability to transfer the 1C 4160V Bus from the 1B Aux Transformer to the 1A Aux Transformer.

JPM H: Respond IAW OP-TM-MAP-C0101 Alarm Response with Failure – Alternate Path – In this JPM, the examinee will have to put the control tower on emergency recirculation. AH-E-18B will trip so the examinee will have to start the opposite train.

JPM I: Manually/Locally operate the turbine bypass valves (MS-V-3A-F) – In this JPM the examinee will take local manual control of MS-V-3C.

JPM J: Emergency Makeup to Nuclear Service Closed Cooling Surge Tank (NS-T-1) – In this JPM the examinee will have to do an emergency fill of the nuclear closed cooling water surge tank.

JPM K: Take Corrective Action for an Unauthorized Waste Gas release – Inplant – In this JPM the examinee will have to identify what a waste gas tank is releasing and take action to stop the release.

Facility: Three Mile IslandDate of Examination: 06/26/17Exam Level: RO ☒ SRO-I ☐ SRO-U ☐Operating Test No.: TMI-2017-1

Control Room Systems: *8 for RO; 7 for SRO-I; 2 or 3 for SRO-U

| System / JPM Title | Type Code* | Safety Function |
|---|-------------|-----------------|
| a. Emergency Core Cooling System / Emergency Borate Using the BAMT as the Source – Alternate Path - 004 A2.14 | A, D, S | 1 |
| b. Makeup System / Removing Makeup Pump 1B from Service – 004 A4.11 | D, S | 2 |
| c. Emergency Core Cooling System / Respond to inadvertant ES actuation – Alternate Path - 006 A2.13 | A, EN, M, S | 3 |
| d. Residual Heat Removal System / Transfer of Reactor Building Sump Recirculation - Alternate Path – 005 A2.04 | A, D, L, S | 4P |
| e. Containment Cooling System / Perform Emergency Operations of Reactor Building Emergency Cooling water - Alternate Path - 022 A4.04 | A, M, S | 5 |
| f. A.C Electrical Distribution / Transfer BOP Busses from 1B to 1A Aux Transformer – 062 A4.01 | M, S | 6 |
| g. Component Cooling Water System / Cross Connect the Secondary River Water System to the Nuclear River Water System - 026 AA2.02 | M, S | 8 |
| h. Radiation Monitoring System / Respond IAW OP-TM-MAP-C0101 Alarm Response with failure – Alternate Path – 072 A3.01 | A, D, P, S | 7 |

In-Plant Systems * (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)

| | | |
|---|------|----|
| i. Main Steam System / Locally / Manually Operate the Turbine Bypass Valves (MS-V-3A-F) 041 A4.08 | D | 4S |
| j. Nuclear Service Closed Cooling Water / Emergency Makeup to Nuclear Service Closed Cooling Surge Tank (NS-T-1) - 008A4.07 | D, E | 8 |
| k. Waste Gas System / Take Corrective Action for an Unauthorized Waste Gas release - 071G2.1.30 | D, R | 9 |

* All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all five SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.

| | |
|--------------|---------------------------------|
| * Type Codes | Criteria for RO / SRO-I / SRO-U |
|--------------|---------------------------------|

| | |
|--|--|
| (A)lternate path | 4-6 / 4-6 / 2-3 |
| (C)ontrol room | |
| (D)irect from bank | ≤ 9 / ≤ 8 / ≤ 4 |
| (E)mergency or abnormal in-plant | ≥ 1 / ≥ 1 / ≥ 1 |
| (EN)gineered safety feature | ≥ 1 / ≥ 1 / ≥ 1 (control room system) |
| (L)ow-Power / Shutdown | ≥ 1 / ≥ 1 / ≥ 1 |
| (N)ew or (M)odified from bank including 1(A) | ≥ 2 / ≥ 2 / ≥ 1 |
| (P)revious 2 exams | ≤ 3 / ≤ 3 / ≤ 2 (randomly selected) |
| (R)CA | ≥ 1 / ≥ 1 / ≥ 1 |
| (S)imulator | |

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JPM A: Emergency Borate Using the BAMT as the Source – Alternate Path - In this JPM the examinee will be directed to perform OP-TM-EOP-010, Rule 5 for emergency boration. Due to malfunctions, the examinee will have to initiate emergency boration using Guide 1.

JPM B: Removing Makeup Pump 1B from Service – In this JPM the examinee will show the ability remove the makeup pump supplying RCS makeup and Seal injection from service while maintaining plant stability.

JPM C: Respond to an Inadvertent ESAS Actuation-Alternate Path – In this JPM the examinee will show the ability to perform the IMA's of OP-TM-AOP-046, INADVERTENT ESAS ACTUATION. The 'B' 500 psig ES signal will not be able to be cleared so the examinee will end up having to throttle open MU-V-16B to ensure proper makeup pump flow.

JPM D: Transfer of Reactor Building Sump Recirculation - Alternate Path – In this JPM the examinee will demonstrate the ability to throttle LPI to within limits after a sump recirculation suction valve fails to open after a LOCA.

JPM E: Perform Emergency Operations of Reactor Building Emergency Cooling Water – Alternate Path – In this JPM the examinee will be directed to initiate Reactor Building Emergency Cooling. This JPM is modified so that RR-V-1B does not open and RR-P-1B must be secured.

JPM F: Transfer BOP Busses from 1B to 1A Aux Transformer – In this JPM the examinee will demonstrate the ability to transfer the 1C 4160V Bus from the 1B Aux Transformer to the 1A Aux Transformer.

JPM G: Cross Connect the Secondary River Water System to the Nuclear River Water System – In this JPM the examinee will have to cross connect Secondary River with Nuclear River water.

JPM H: Respond IAW OP-TM-MAP-C0101 Alarm Response with Failure – Alternate Path – In this JPM, the examinee will have to put the control tower on emergency recirculation. AH-E-18B will trip so the examinee will have to start the opposite train.

JPM I: Manually/Locally operate the turbine bypass valves (MS-V-3A-F) – In this JPM the examinee will take local manual control of MS-V-3C.

JPM J: Emergency Makeup to Nuclear Service Closed Cooling Surge Tank (NS-T-1) – In this JPM the examinee will have to do an emergency fill of the nuclear closed cooling water surge tank.

JPM K: Take Corrective Action for an Unauthorized Waste Gas release – Inplant – In this JPM the examinee will have to identify what a waste gas tank is releasing and take action to stop the release.

| | | | | | |
|--|--|-------------------------|--|--------------|-------------------|
| Facility: | Three Mile Island | Scenario No.: | 1 | Op Test No.: | <u>TMI-2017-1</u> |
| Examiners: | _____ | Operators: | _____ | | |
| | _____ | | _____ | | |
| | _____ | | _____ | | |
| Initial Conditions: | <ul style="list-style-type: none"> 100% power, MOL EG-Y-1A "A" Diesel Generator Out of Service Generator output meter GN-OM-1 is out of service for repair. Put computer points A0099 and A0098 on data trend to monitor MVAR and MW's. | | | | |
| Turnover: | EG-Y-1A 7 day LCO has expired. Plant is beginning a shutdown. Directed rate of change of reactor power is 1%/minute | | | | |
| Critical Tasks: | <ul style="list-style-type: none"> Control RCS Inventory (CT-30) Natural Circulation RCS Flow (CT-12) | | | | |
| Event No. | Malf. No. | Event Type* | Event Description | | |
| 1 | | R CRS R URO | Shutdown reactor in 1102-4 (Allow power to lower >10%) (ICS in Auto, ULD in Hand) | | |
| 2 | | TS CRS | EF-P-1 oil bubbler empty, EF-P-1 inoperable | | |
| 3 | RW02A | TS CRS C ARO | NR-P-1A Trips, NR-P-1B Fails to Auto-Start, entry into OP-TM-MAP-B0105, and OP-TM-MAP-B0205 (ARO: Starts NR-P-1B from CR) | | |
| 4 | IC09 IC53 | I CRS I URO I ARO | ICS Malfunction, entry into OP-TM-AOP-070 (Main Generator Megawatts fails to 50%, SASS fails to actuate) | | |
| 5 | ED22C | I CRS I URO I ARO | Loss of ICS AUTO Subfeed Power (MU), entry into OP-TM-MAP-H0108 (URO: Operate MU-V-32 in HAND, ARO: Restore letdown) | | |
| 6 | ED01 | M CRS M URO M ARO | Loss of Offsite power with one Emergency Diesel available, Entry into OP-TM-AOP-020 | | |
| 7 | FW62C | C CRS C ARO | EF-P-2B trips, Entry into OP-TM-EOP-004, Lack of Heat Transfer | | |
| 8 | | C CRS C ARO | Places the SBO diesel on the 1D 4KV bus, starts EF-P-2A | | |
| * (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor | | | | | |

Facility: Three Mile Island Scenario No.: 2 Op Test No.: TMI-2017-1

Examiners: _____

Operators: _____

- Initial Conditions:
- 85% power, MOL, load following
 - EG-Y-1A is 2 days into a 6 day system outage
 - Feedwater pump control is on the MSC

Turnover: Maintain 85% power

- Critical Tasks:
- Trip All Reactor Coolant Pumps (CT-1)
 - Reduce Steaming/Isolate Affected SGs (CT-22)

| Event No. | Malf. No. | Event Type* | Event Description |
|-----------|-----------|--------------------------|---|
| 1 | ES08A | TS CRS I URO I ARO | Inadvertent 1600# ES actuation, "A" train, enter OP-TM-AOP-046 (URO: AOP-046 IMA's, ARO: Restores Letdown) |
| 2 | TH17A | TS CRS R URO | 'A' OTSG Tube Leak, TS call, Reactivity manipulation (URO: Lowers power) |
| 3 | TH13C | C CRS C ARO | RC-P-1C High Vibrations (ARO: Secures RCP) |
| 4 | IC63 | I CRS I URO I ARO | Feedwater fails to re-ratio on loss of RCP |
| 5 | TH16A | M CRS M URO M ARO | 'A' OTSG tube rupture, requiring HPI initiation, entry into OP-TM-EOP-001 |
| 6 | MU23A | C CRS C URO | MU-P-1A fails to start on ES (URO: Starts MU-P-1A) |
| 7 | | C CRS C URO C ARO | Loss of SCM, entry into OP-TM-EOP-002, then return to OP-TM-EOP-005 (URO: Rule 1, ARO: Steams 'A' OTSG) |

* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor

| | | | | | |
|--|---|-------------------------|---|--------------|-------------------|
| Facility: | Three Mile Island | Scenario No.: | 3 | Op Test No.: | <u>TMI-2017-1</u> |
| Examiners: | _____ | Operators: | _____ | | |
| | _____ | | _____ | | |
| | _____ | | _____ | | |
| Initial Conditions: | <ul style="list-style-type: none"> 100% power, MOL Generator output meter GN-OM-1 is out of service for repair. Put computer points A0099 and A0098 on data trend to monitor MVAR and MW's. | | | | |
| Turnover: | Remain at 100% power | | | | |
| Critical Tasks: | <ul style="list-style-type: none"> Natural Circulation RCS Flow (CT-12) Isolate Overcooling SG(s) (CT-17) | | | | |
| Event No. | Malf. No. | Event Type* | Event Description | | |
| 1 | ZAOWDL LI806 | TS CRS | RB Flood Level Instrument Fails High (TS) | | |
| 2 | MS04 | C CRS C URO C ARO | MSIV inadvertent closure, entry into OP-TM-PPC-L2204 (ATC: Lowers power < 90%), (BOP: Opens MS-V-1D) | | |
| 3 | IC18 | I CRS R URO | ULD fails @ 98% in auto (URO: Lowers power with SG/RX Demand to less than 98%) | | |
| 4 | ED09C | TS CRS C ARO | Loss of Vital Bus "C" (ARO: RM-A-8G interlock to defeat) | | |
| 5 | MS19A | C CRS C ARO | Isolable Steam Leak in Turbine Bldg, entry into OP-TM-AOP-051. 'B' OTSG (ARO: Isolate Steam Leak) | | |
| 6 | TC01 RD28 | I CRS I URO | Turbine Trips, Reactor fails to automatically trip (URO: IMA's) | | |
| 7 | ED01 | M CRS M URO M ARO | Loss of Offsite Power with both Emergency Diesel Generators available, entry into OP-TM-AOP-020. | | |
| 8 | MS07B | C CRS C ARO | Stuck open MSSV's, entry into OP-TM-EOP-003. (ARO: Isolate "B" OTSG) | | |
| * (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor | | | | | |