

Waterford
2007 NRC Initial License Written Examination
Written Examination Outline Methodology

The written examination outline was developed using a proprietary electronic random outline generator developed by Western Technical Services, Inc.

The software was designed to provide a written examination outline in accordance with the criteria contained in NUREG 1021, Revision 9.

The application was developed using Visual Basic code, relying on a true random function based on the PC system clock. The random generator selects topics in a Microsoft Access Database containing Revision 2 of the PWR K&A catalogue. The selected data is then written to a separate data table. The process for selection of topics is similar to the guidance in ES-401, Attachment 1.

The attached outline report and plant specific suppression profile report are written directly from the data tables created by the software. Electronic copies of the data tables are on file.

The process used to develop the outlines is as follows:

- For Tier 1 and Tier 2 generic items, only the items required to be included in accordance with ES-401, Attachment 2 are included in the generation process.
- Outline is generated for all topics with KA importance ≥ 2.5 .
- 25 SRO topics are randomly selected from Tier 1 AA2 and required generic items, Tier 2 A2 and required generic items, (including all System 034 topics) and Tier 3 generic items (All with ties to 10CFR55.43). 75 RO topics are randomly selected to complete the outline, 100 topics total.
- The exam report generated lists the topic (Question) number in the far right column. RO topics are numbered 1-75, and SRO topics are numbered 76–100. The SRO topics are written in red ink for ease of identification.
- Items that are rejected after the initial generation process are placed on the rejected items page. Replacement topics are either randomly generated or are inserted upon direction of the Chief Examiner.
- Disposition of any item randomly selected but not included in the outline is documented and included.

Facility:		Waterford 3 2007 NRC Retake											Date of Exam:		11/8/2007				
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	K	A	A 2	G *	Total	
1. Emergency & Abnormal Plant Evolutions	1	3	3	3				3	3			3	18					6	
	2	1	1	2				2	1			2	9					4	
	Tier Totals	4	4	5				5	4			5	27					10	
2. Plant Systems	1	4	3	3	2	1	2	3	2	3	3	2	28					5	
	2	1	0	1	1	1	1	1	1	1	1	1	10					3	
	Tier Totals	5	3	4	3	2	3	4	3	4	4	3	38					8	
3. Generic Knowledge and Abilities Categories					1	2	3	4					10	1	2	3	4	7	
					2	3	2	3											
Note:	1.	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).																	
	2.	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.																	
	3.	Systems/evolutions within each group are identified on the associated outline; systems or evolutions that do not apply at the facility should be deleted and justified; operationally important, site-specific systems that are not included on the outline should be added. Refer to ES-401, Attachment 2, for guidance regarding elimination of inappropriate K/A statements.																	
	4.	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.																	
	5.	Absent a plant specific priority, only those KAs 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.																	
	6.	Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.																	
	7.*	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.																	
	8.	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 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.																	
	9.	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 10CFR55.43																	

Waterford 3
NRC Written Examination Outline
Emergency and Abnormal Plant Evolutions – Tier 1 Group 1

E/APE # / Name Safety Function	G	K1	K2	K3	A1	A2	Number	K/A Topic(s)	Imp.	Q#
007 / Reactor Trip - Stabilization - Recovery / 1						X	EA2.02	Ability to determine or interpret the following as they apply to a reactor trip: Proper actions to be taken if the automatic safety functions have not taken place	4.3	39
008 / Pressurizer Vapor Space Accident / 3		X					AK1.01	Knowledge of the operational implications of the following concepts as they apply to a Pressurizer Vapor Space Accident: Thermodynamics and flow characteristics of open or leaking valves	3.2	40
009 / Small Break LOCA / 3					X		EA1.12	Ability to operate and monitor the following as they apply to a small break LOCA: RPS	4.2	41
011 / Large Break LOCA / 3	X						2.1.23	Conduct of Operations: Ability to perform specific system and integrated plant procedures during all modes of plant operation.	3.9	42
022 / 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 Pump Makeup: Relationship between charging flow and PZR level	3.0	43
025 / Loss of RHR System / 4		X					AK1.01	Knowledge of the operational implications of the following concepts as they apply to Loss of Residual Heat Removal System: Loss of RHRS during all modes of operation	3.9	44
026 / Loss of Component Cooling Water / 8	X						2.1.33	Conduct of Operations: Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.	3.4	45
027 / Pressurizer Pressure Control System Malfunction / 3			X				AK2.03	Knowledge of the interrelations between the Pressurizer Pressure Control Malfunctions and the following: Controllers and positioners	2.6	46
029 / ATWS / 1			X				EK2.06	Knowledge of the interrelations between the and the following an ATWS: Breakers, relays, and disconnects	2.9	47
038 / Steam Gen. Tube Rupture / 3					X		EA1.16	Ability to operate and monitor the following as they apply to a SGTR: SG atmospheric relief valves and secondary PORV controllers and indicators	4.4	48
055 / Station Blackout / 6	X						2.4.6	Emergency Procedures / Plan Knowledge of symptom based EOP mitigation strategies	3.1	49
056 / Loss of Off-site Power / 6						X	AA2.57	Ability to determine and interpret the following as they apply to the Loss of Offsite Power: RCS hot leg and cold leg temperatures	3.9	50

Waterford 3
 NRC Written Examination Outline
 Emergency and Abnormal Plant Evolutions – Tier 1 Group 1

E/APE # / Name Safety Function	G	K1	K2	K3	A1	A2	Number	K/A Topic(s)	Imp.	Q#
057 / 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	51
058 / Loss of DC Power / 6				X			AK3.02	Knowledge of the reasons for the following responses as they apply to the Loss of DC Power: Actions contained in EOP for loss of dc power	4.0	52
062 / Loss of Nuclear Svc. Water / 4					X		AA1.05	Ability to operate and / or monitor the following as they apply to the Loss of Nuclear Service Water: The CCWS surge tank, including level control and level alarms, and radiation alarm	3.1	53
065 / Loss of Instrument Air / 8						X	AA2.06	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	54
E05 / Steam Line Rupture - Excessive Heat Transfer / 4				X			EK3.2	Knowledge of the reasons for the following responses as they apply to the (Excess Steam Demand) Normal, abnormal and emergency operating procedures associated with (Excess Steam Demand).	3.3	55
E06 / Loss of Main Feedwater / 4			X				EK2.1	Knowledge of the interrelations between the (Loss of Feedwater) and the following: Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	3.3	56
K/A Category Point Totals:	3	3	3	3	3	3	Group Point Total:			18

Waterford 3
NRC Written Examination Outline
Emergency and Abnormal Plant Evolutions – Tier 1 Group 2

E/APE # / Name Safety Function	G	K1	K2	K3	A1	A2	Number	K/A Topic(s)	Imp.	Q#
001 / Continuous Rod Withdrawal / 1				X			AK3.02	Knowledge of the reasons for the following responses as they apply to the Continuous Rod Withdrawal: Tech Spec limits on rod operability	3.2	57
003 / Dropped Control Rod / 1						X	AA2.01	Ability to determine and interpret the following as they apply to the Dropped Control Rod: Rod position indication to actual rod position	3.7	58
059 / Accidental Liquid RadWaste Rel. / 9				X			AK3.01	Knowledge of the reasons for the following responses as they apply to the Accidental Liquid Radwaste Release: Termination of release of radioactive liquid	3.5	59
060 / Accidental Gaseous RadWaste Rel. / 9					X		AA1.02	Ability to operate and / or monitor the following as they apply to the Accidental Gaseous Radwaste: Ventilation system	2.9	60
067 / Plant Fire On-site / 8					X		AA1.08	Ability to operate and / or monitor the following as they apply to the Plant Fire on Site: Fire fighting equipment used on each class of fire	3.4	61
076 / High Reactor Coolant Activity / 9	X						2.1.32	Conduct of Operations: Ability to explain and apply all system limits and precautions	3.4	62
A11 / RCS Overcooling - PTS / 4	X						2.1.27	Conduct of Operations: Knowledge of system purpose and or function.	2.8	63
A13 / Natural Circ. / 4		X					AK1.1	Knowledge of the operational implications of the following concepts as they apply to the (Natural Circulation Operations) Components, capacity, and function of emergency systems.	3.0	64
E09 / Functional Recovery			X				EK2.2	Knowledge of the interrelations between the (Functional Recovery) and the following: Facility's heat removal systems, including primary coolant, emergency coolant, the decay heat removal systems, and relations between the proper operation of these systems to the operation of the facility.	3.7	65
K/A Category Point Total:	2	1	1	2	2	1	Group Point Total:			9

Waterford 3
NRC Written Examination Outline
Plant Systems – Tier 2 Group 1

System #/Name	G	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	Number	K/A Topics	Imp.	Q#
003 Reactor Coolant Pump	X											2.4.50	Emergency Procedures / Plan Ability to verify system alarm setpoints and operate controls identified in the alarm response manual.	3.3	1
003 Reactor Coolant Pump							X					K6.02	Knowledge of the effect of a loss or malfunction on the following will have on the RCPS: RCP seals and seal water supply	2.7	2
004 Chemical and Volume Control										X		A3.15	Ability to monitor automatic operation of the CVCS, including: PZR pressure and temperature	3.5	3
005 Residual Heat Removal											X	A4.03	Ability to manually operate and/or monitor in the control room: RHR temperature, PZR heaters and flow, and nitrogen	2.8	4
006 Emergency Core Cooling				X								K3.01	Knowledge of the effect that a loss or malfunction of the ECCS will have on the following: RCS	4.1	5
007 Pressurizer Relief/Quench Tank				X								K3.01	Knowledge of the effect that a loss or malfunction of the PRTS will have on the following: Containment	3.3	6
008 Component Cooling Water		X										K1.04	Knowledge of the physical connections and/or cause-effect relationships between the CCWS and the following systems: RCS, in order to determine source(s) of RCS leakage into the CCWS	3.3	7
008 Component Cooling Water								X				A1.01	Ability to predict and/or monitor changes in parameters to prevent exceeding design limits) associated with operating the CCWS controls including: CCW flow rate	2.8	8
010 Pressurizer Pressure Control								X				A1.04	Ability to predict and/or monitor changes in parameters (to prevent exceeding design limits) associated with operating the PZR PCS controls including: Effects of temperature change during solid operation	3.6	9
012 Reactor Protection			X									K2.01	Knowledge of bus power supplies to the following: RPS channels, components, and interconnections	3.3	10
012 Reactor Protection										X		A3.07	Ability to monitor automatic operation of the RPS, including: Trip breakers	4.0	11
013 Engineered Safety Features Actuation				X								K3.03	Knowledge of the effect that a loss or malfunction of the ESFAS will have on the following: Containment	4.3	12
013 Engineered Safety Features Actuation						X						K5.02	Knowledge of the operational implications of the following concepts as they apply to the ESFAS: Safety system logic and reliability	2.9	13
022 Containment Cooling			X									K2.01	Knowledge of power supplies to the following: Containment Cooling Fans	3.0	14
022 Containment Cooling											X	A4.01	Ability to manually operate and/or monitor in the control room: CCS fans	3.6	15

Waterford 3
NRC Written Examination Outline
Plant Systems – Tier 2 Group 1

System #/Name	G	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	Number	K/A Topics	Imp.	Q#
026 Containment Spray		X										K1.02	Knowledge of the physical connections and/or cause-effect relationships between the CSS and the following systems: Cooling water	4.1	16
026 Containment Spray					X							K4.01	Knowledge of CSS design feature(s) and/or interlock(s) which provide for the following: Source of water for CSS, including recirculation phase after LOCA	4.2	17
039 Main and Reheat Steam								X				A1.05	Ability to predict and/or monitor changes in parameters (to prevent xceeding design limits) associated with operating the MRSS ontrols including: RCS T-ave	3.2	18
059 Main Feedwater		X										K1.03	Knowledge of the physical connections and/or cause-effect relationships between the MFW and the following systems: S/GS	3.1	19
061 Auxillary/Emergency Feedwater			X									K2.02	Knowledge of bus power supplies to the following: AFW electric driven pumps	3.7	20
062 AC Electrical Distribution	X											2.4.6	Emergency Procedures/Plan: Knowledge of symptom based EOP mitigation strategies	3.1	21
063 DC Electrical Distribution					X							K4.04	Knowledge of dc electrical system design feature(s) and/or interlock(s) which provide for the following: Trips	2.6	22
064 Emergency Diesel Generator							X					K6.08	Knowledge of the effect of a loss or malfunction of the following will have on the ED/G system: Fuel oil storage tanks	3.2	23
064 Emergency Diesel Generator											X	A4.09	Ability to manually operate and/or monitor in the control room: Establishing power from the ring bus (to relieve ED/G)	3.2	24
073 Process Radiation Monitoring		X										K1.01	Knowledge of the physical connections and/or cause-effect relationships between the PRM system and the following systems: Those systems served by PRMs	3.6	25
076 Service Water									X			A2.01	Ability to (a) predict the impacts of the following malfunctions or operations on the SWS; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Loss of SWS	3.5	26
078 Instrument Air										X		A3.01	Ability to monitor automatic operation of the IAS, including: Air pressure	3.1	27
103 Containment									X			A2.03	Ability to (a) predict the impacts of the following malfunctions or operations on the containment system- and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations Phase A and B isolation	3.5	28
K/A Category Point Totals:	2	4	3	3	2	1	2	3	2	3	3	Group Point Total:			28

Waterford 3
NRC Written Examination Outline
Plant Systems – Tier 2 Group 2

System #/Name	G	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	Number	K/A Topics	Imp.	Q#
001 Control Rod Drive						X						K5.06	Knowledge of the following operational implications as they apply to the CRDS: Effects of control rod motion on axial offset	3.8	29
002 Reactor Coolant		X										K1.06	Knowledge of the physical connections and/or cause-effect relationships between the RCS and the following systems: CVCS	3.7	30
014 Rod Position Indication											X	A4.02	Ability to manually operate and/or monitor in the control room: Control rod mode-select switch	3.4	31
015 Nuclear Instrumentation										X		A3.03	Ability to monitor automatic operation of the NIS, including: Verification of proper functioning/operability	3.9	32
017 In-core Temperature Monitor	X											2.4.3	Emergency Procedures / Plan Ability to identify post-accident instrumentation	3.5	33
028 Hydrogen Recombiner and Purge Control				X								K3.01	Knowledge of the effect that a loss or malfunction of the HRPS will have on the following: Hydrogen concentration in Containment	3.3	34
033 Spent Fuel Pool Cooling									X			A2.03	Ability to (a) predict the impacts of the following malfunctions or operations on the Spent Fuel Pool Cooling System ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those malfunctions or operations: Abnormal Spent Fuel Pool water level or loss of water level	3.1	35
035 Steam Generator							X					K6.01	Knowledge of the effect of a loss or malfunction on the following will have on the S/GS: MSIVs	3.2	36
045 Main Turbine Generator					X							K4.43	Knowledge of MT/G system design feature(s) and/or inter-lock(s) which provide for the following: T-ave. program, in relation to SDS controller	2.8	37
071 Waste Gas Disposal								X				A1.06	Ability to predict and/or monitor changes in parameters(to prevent exceeding design limits) associated with Waste Gas Disposal System operating the controls including: Ventilation system	2.5	38
K/A Category Point Totals:	1	1	0	1	1	1	1	1	1	1	1	Group Point Total:			10

Facility:	Waterford 3 2007 NRC Retake	Date of Exam:	11/8/2007			
Category	K/A #	Topic	RO		SRO-Only	
			IR	Q#	IR	Q#
	2.1.22	Ability to determine Mode of Operation.	2.8	66		
	2.1.17	Ability to make accurate, clear and concise verbal reports.	3.5	67		
	Subtotal			2		
	2.2.27	Knowledge of the refueling process.	2.6	68		
	2.2.2	Ability to manipulate the console controls as required to operate the facility between shutdown and designated power levels	4.0	69		
	2.2.13	Knowledge of tagging and clearance procedures.	3.6	70		
	Subtotal			3		
	2.3.11	Ability to control radiation releases.	2.7	71		
	2.3.4	Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.	2.5	72		
	Subtotal			2		
	2.4.10	Knowledge of annunciator response procedures.	3.0	73		
	2.4.2	Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions.	3.9	74		
	2.4.12	Knowledge of general operating crew responsibilities during emergency operations.	3.4	75		
	Subtotal			3		
Tier 3 Point Total				10		7

Tier / Group	Randomly Selected K/A	Reason for Rejection
1 / 1	055 G2.4.30	KA importance value less than 2.5, randomly reselected G2.4.6
1 / 1	038 EA1.43	NA for WF3,ADV left in auto don't manually isolate for SGTR Randomly replaced with 038 EA1.16
1 / 1	056 AA2.49	NA for WF3, don't strip loads to prevent overloading EDG. Everything designed to function automatically. Randomly replaced with 056 AA2.57
1 / 2	001 AK3.01	Difficult to prepare a psychometrically sound question related to the subject K/A. Vague procedural guidance for restoration. Randomly replaced with 001 AK3.02
1 / 2	059 AK3.02	Knowledge required of topic is not RO level. No RO Tasks associated with topic Randomly replaced with 059 AK3.01
1 / 2	076 G2.1.14	Low discriminatory value; procedures do not support topic Randomly replaced with 076 G2.1.32
2 / 1	010 A1.08	Not valid for facility; don't log Delta T for nozzles anymore. Randomly replaced with 010 A1.04
2 / 1	012 A3.03	Oversampling and duplication, significant number of power supply-related items Randomly replaced with 012 A3.07
2 / 1	013 K5.01	Low operational validity and discriminatory value; no plausible tie between definition and implications. Randomly replaced with 013 K5.02
2 / 1	022 K2.02	No credible tie between chillers and containment cooling. Randomly replaced with 022 K2.01
2 / 1	061 K2.03	NA for facility; No diesel AFW or EFW pump Randomly replaced with 061 K2.02
2 / 1	062 G2.1.14	Low operational validity; Difficult to prepare a psychometrically sound question related to the subject Randomly replaced with 062 G2.4.6
2 / 1	073 K5.01	Low operational validity low discriminatory value GFES type question. Randomly replaced with 073 K1.01
2 / 2	001 K5.17	No credible tie between topic and plant procedures. Randomly replaced with 001 K5.06
2 / 2	002 K1.08	Duplicate information with question #5, excessive overlap Randomly replaced with 002 K1.06
2 / 2	017 G2.4.49	No immediate operator actions associated with in-core TCs. Randomly replaced with 017 G2.4.3
2 / 2	028 K2.01	3 rd low level power supply question; would not provide discriminatory RO level question. Low importance factor, system not safety related. Randomly replaced with 028 K3.01
2 / 2	034 A2.03	Not RO level KA. Randomly replaced with 033 A2.03
3	G2.2.11	SRO level topic; No RO tasks associated with this topic. Randomly replaced with G2.2.2
3	G2.4.13	Similar to Tier 3 2.4.12, only EOP flow chart for WF3 is diagnostic which is more SRO level task. Randomly replaced with G2.4.10