

# RO Outline

ES-401

BWR Examination Outline

Form ES-401-1

Facility: Limerick		Date of Exam: October 2008																
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	4	4	2	N/A			5	3	N/A			2	20	3	4	7	
	2	1	3	0				2	0				1	7	1	2	3	
	Tier Totals	5	7	2				7	3				3	27	4	6	10	
2. Plant Systems	1	3	2	2	4	1	3	3	1	3	2	2	26	3	2	5		
	2	2	0	0	0	1	3	0	1	0	2	3	12	1	2	3		
	Tier Totals	5	2	2	4	2	6	3	2	3	4	5	38	4	4	8		
3. Generic Knowledge and Abilities Categories				1		2		3		4		10		1	2	3	4	7
				2		3		2		3				1	2	2	2	
<p>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).</p> <p>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.</p> <p>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/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.</p> <p>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.</p> <p>5. 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.</p> <p>6. Select SRO topics for Tiers 1 and 2 from the shaded systems and K/A categories.</p> <p>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. Refer to Section D.1.b of ES-401 for the applicable K/As.</p> <p>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.</p> <p>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 10 CFR 55.43.</p>																		

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E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4	X						<b>K1.02</b> - Knowledge of the operational implications of <b>Power/flow distribution</b> as it applies to <b>PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION</b>	3.3	1
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4					X		<b>A2.02</b> - Ability to determine and/or interpret <b>Neutron monitoring</b> as they apply to <b>PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION</b>	3.1	2
295004 Partial or Total Loss of DC Pwr / 6					X		<b>A2.04</b> - Ability to determine and/or interpret <b>System lineups</b> as it applies to <b>PARTIAL OR TOTAL LOSS OF DC PWR</b>	3.2	3
295005 Main Turbine Generator Trip / 3	X						<b>K2.01</b> - Knowledge of the interrelations between <b>MAIN TURBINE GENERATOR TRIP</b> and <b>Feedwater temperature.</b>	3.8	4
295006 SCRAM / 1				X			<b>A1.02</b> - Ability to operate and/or monitor <b>Reactor water level control system</b> as it applies to <b>SCRAM</b>	3.9	5
295016 Control Room Abandonment / 7			X				<b>A3.01</b> - Knowledge of the reasons for <b>Reactor SCRAM</b> as it applies to <b>CONTROL ROOM ABANDONMENT</b>	4.1	6
295018 Partial or Total Loss of CCW / 8		X					<b>K2.02</b> - Knowledge of the interrelations between <b>PARTIAL OR TOTAL LOSS OF CCW</b> and <b>Plant operations.</b>	3.4	7
295019 Partial or Total Loss of Inst. Air / 8					X		<b>A2.02</b> - Ability to determine and/or interpret <b>Status of safety-related instrument air system loads</b> as it applies to <b>PARTIAL OR TOTAL LOSS OF INST. AIR.</b>	3.6	8
295021 Loss of Shutdown Cooling / 4	X						<b>K1.03</b> - Knowledge of the operational implications of <b>Adequate core cooling</b> as it applies to <b>LOSS OF SHUTDOWN COOLING.</b>	3.9	9
295023 Refueling Accident / 8	X						<b>K1.02</b> - Knowledge of the operational implications of <b>Shutdown margin</b> as it applies to <b>REFUELING ACCIDENT.</b>	3.2	10
295024 High Drywell Pressure / 5						X	<b>G2.1.23</b> - Ability to perform specific system and integrated plant procedures during all modes of plant operation, as it relates to <b>HIGH DRYWELL PRESSURE.</b>	3.9	11

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ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 1 (RO / SRO)						Form ES-401-1		
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295025 High Reactor Pressure / 3			X				<b>K3.08</b> - Knowledge of the reasons for Reactor/turbine pressure regulating system operation as it applies to HIGH REACTOR PRESSURE.	3.5	12
295026 Suppression Pool High Water Temp. / 5				X			<b>A1.03</b> - Ability to operate and/or monitor <b>Temperature monitoring</b> as it applies to SUPPRESION POOL HIGH WATER TEMPERATURE.	3.9	13
295027 High Containment Temperature / 5	N/A								
295028 High Drywell Temperature / 5		X					<b>K2.03</b> - Knowledge of the interrelations between HIGH DRYWELL TEMPERATURE and <b>Reactor water level indication.</b>	3.6	14
295030 Low Suppression Pool Water Level / 5				X			<b>A1.01</b> - Ability to operate and/or monitor <b>ECCS systems (NPSH considerations)</b> as it applies to LOW SUPPRESSION POOL WATER LEVEL.	3.6	15
295031 Reactor Low Water Level / 2				X			<b>A1.13</b> -- Ability to operate and/or monitor the <b>Reactor Water Level Control</b> as it applies to REACTOR LOW WATER LEVEL	4.3	16
295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1		X					<b>K2.03</b> - Knowledge of the interrelations between SCRAM CONDITION PRESENT AND REACTOR POWER ABOVE APRM DOWNSCALE OR UNKNOWN and <b>ARI/RPT/ATWS.</b>	4.1	17
295038 High Off-site Release Rate / 9	X						<b>K1.02</b> - Knowledge of the operational implications of <b>Protection of the general public</b> as it applies to HIGH OFF-SITE RELEASE RATE	4.2	18
600000 Plant Fire On Site / 8						X	<b>G2.4.11</b> -Knowledge of abnormal condition procedures, as it relates to PLANT FIRE ON SITE.	4.0	19
700000 Generator Voltage and Electric Grid Disturbances / 6				X			<b>A1.05</b> - Ability to operate and/or monitor <b>Engineered safety features</b> as it applies to GENERATOR VOLTAGE AND ELECTRIC GRID DISTURBANCES.	3.9	20

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E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
K/A Category Totals:							Group Point Total:		20/7

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E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295002 Loss of Main Condenser Vac / 3									
295007 High Reactor Pressure / 3									
295008 High Reactor Water Level / 2				X			<b>A1.01</b> – Ability to operate or monitor <b>reactor level control</b> as it applies to <b>HIGH REACTOR WATER LEVEL</b> .	3.6	<b>23</b>
295009 Low Reactor Water Level / 2				X			<b>A1.01</b> - Ability to operate and/or monitor <b>Reactor feedwater</b> as it applies to <b>LOW REACTOR WATER LEVEL</b> .	3.9	<b>22</b>
295010 High Drywell Pressure / 5									
295011 High Containment Temp / 5	N/A								
295012 High Drywell Temperature / 5									
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1									
295015 Incomplete SCRAM / 1		X					<b>K2.02</b> - Knowledge of the interrelations between <b>INCOMPLETE SCRAM</b> and <b>RMCS</b> .	3.6	<b>21</b>
295015 Incomplete SCRAM / 1						X	<b>G2.4.9</b> - Knowledge of low power/shutdown implications in accident (e.g., loss of coolant accident or loss of residual heat removal) mitigation strategies, as it relates to <b>INCOMPLETE SCRAM</b> .	3.8	<b>24</b>
295017 High Off-site Release Rate / 9									
295020 Inadvertent Cont. Isolation / 5 & 7		X					<b>K2.03</b> - Knowledge of the interrelations between <b>INADVERTENT CONTAINMENT ISOLATION</b> and <b>Drywell/containment ventilation/cooling</b> .	3.1	<b>25</b>
295022 Loss of CRD Pumps / 1									
295029 High Suppression Pool Wtr Lvl / 5									
295032 High Secondary Containment Area Temperature / 5		X					<b>K1.02</b> - Knowledge of the operational implications of <b>Radiation releases</b> as it applies to <b>HIGH SECONDARY CONTAINMENT AREA TEMPERATURE</b> .		<b>26</b>
295033 High Secondary Containment Area Radiation Levels / 9									

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ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO)							Form ES-401-1	
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295034 Secondary Containment Ventilation High Radiation / 9			X				<b>K2.04 - Knowledge of the interrelations between SECONDARY CONTAINMENT VENTILATION HIGH RADIATION and secondary containment ventilation.</b>	3.9	<b>27</b>
295035 Secondary Containment High Differential Pressure / 5									
295036 Secondary Containment High Sump/Area Water Level / 5									
500000 High CTMT Hydrogen Conc. / 5									
K/A Category Point Totals:							Group Point Total:		<b>7/3</b>

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Form ES-401-1

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 1 (RO / SRO)										Form ES-401-1			
System # / Name	K	K	K	K	K	K	A	A	A	A	G	K/A Topic(s)	IR	#
	1	2	3	4	5	6	1	2	3	4				
203000 RHR/LPCI: Injection Mode				X								<b>K4.0.1</b> - Knowledge of RHR/LPCI: INJECTION MODE design feature(s) and/or interlocks which provide for <b>Automatic system initiation/injection</b> .	4.2	<b>28</b>
205000 Shutdown Cooling						X						<b>K6.05</b> - Knowledge of the effect that a loss or malfunction of <b>A.C. electrical power</b> will have on the SHUTDOWN COOLING System.	3.3	<b>29</b>
206000 HPCI		X										<b>K2.03</b> - Knowledge of electrical power supplies to <b>Initiation logic</b> .	2.8	<b>30</b>
206000 HPCI				X								<b>K4.11</b> - Knowledge of HIGH PRESSURE COOLANT INJECTION SYSTEM design feature(s) and/or interlocks which provide for <b>Turbine speed control</b> .	3.4	<b>31</b>
207000 Isolation (Emergency) Condenser	N/A													
209001 LPCS							X					<b>A1.08</b> - Ability to predict and/or monitor changes in parameters associated with operating the LOW PRESSURE CORE SPRAY SYSTEM controls including <b>System lineup</b> .	3.3	<b>32</b>
209001 LPCS									X			<b>A3.04</b> - Ability to monitor automatic operations of the LOW PRESSURE CORE SPRAY SYSTEM including <b>System flow</b> .	3.7	<b>33</b>
209002 HPCS	N/A													
211000 SLC				X								<b>K4.04</b> - Knowledge of STANDBY LIQUID CONTROL SYSTEM design feature(s) and/or interlocks which provide for <b>Indication of fault in explosive valve firing circuits</b> .	3.8	<b>34</b>
212000 RPS			X									<b>A4.04</b> - Ability to manually operate and/or monitor in the control room: <b>Bypass SCRAM instrument volume high level SCRAM signal</b> .	3.9	<b>35</b>
212000 RPS							X					<b>A1.08</b> - Ability to predict and/or monitor changes in parameters associated with operating the REACTOR PROTECTION SYSTEM controls including <b>valve position</b> .	3.4	<b>36</b>
215003 IRM			X									<b>K3.02</b> - Knowledge of the effect that a loss or malfunction of the INTERMEDIATE RANGE MONITOR system will have on <b>Reactor manual control</b> .	3.6	<b>37</b>

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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	#
215004 Source Range Monitor									X			<b>A3.02</b> - Ability to monitor automatic operations of the SOURCE RANGE MONITOR SYSTEM including <b>Annunciator and alarm signals</b> .	3.3	<b>38</b>
215005 APRM / LPRM										X		<b>A4.06</b> - Ability to manually operate and/or monitor in the control room: <b>Verification of proper functioning/ operability</b> .	3.6	<b>39</b>
215005 APRM / LPRM				X								<b>K4.07</b> - Knowledge of AVERAGE POWER RANGE MONITOR/LOCAL POWER RANGE MONITOR SYSTEM design feature(s) and/or interlocks which provide for: <b>Flow-biased trip setpoints</b> .	3.7	<b>40</b>
217000 RCIC	X											<b>K1.03</b> - Knowledge of the physical connections and/or cause-effect relationships between REACTOR CORE ISOLATION COOLING and <b>Suppression pool</b> .	3.6	<b>41</b>
217000 RCIC								X				<b>A2.14</b> - Ability to (a) predict the impacts of <b>Rupture Disk failure: Exhaust Diaphragm</b> on the REACTOR CORE ISOLATION COOLING SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations:	3.3	<b>42</b>
218000 ADS						X						<b>K6.01</b> - Knowledge of the effect that a loss or malfunction of <b>RHR/LPCI system pressure</b> will have on the AUTOMATIC DEPRESSURIZATION System.	3.9	<b>43</b>
223002 PCIS/Nuclear Steam Supply Shutoff							X					<b>A1.04</b> - Ability to predict and/or monitor changes in parameters associated with operating the PCIS / NUCLEAR STEAM SUPPLY SHUTTOFF SYSTEM controls including <b>Individual system relay status</b> .	2.6	<b>44</b>
239002 SRVs		X										<b>K2.01</b> - Knowledge of electrical power supplies to <b>SRV solenoids</b> .	2.8	<b>45</b>
259002 Reactor Water Level Control					X							<b>K5.03</b> - Knowledge of the operational implications of Water level measurement as it applies to REACTOR WATER LEVEL CONTROL SYSTEM.	3.1	<b>46</b>
261000 SGTS									X			<b>A3.01</b> - Ability to monitor automatic operations of the STANDBY GAS TREATMENT SYSTEM including <b>System flow</b> .	3.2	<b>47</b>
262001 AC Electrical Distribution			X									<b>K3.01</b> - Knowledge of the effect that a loss or malfunction of the AC ELECTRICAL DISTRIBUTION system will have on Emergency generators	3.8	<b>48</b>

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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	#
262002 UPS (AC/DC)						X						<b>K6.03</b> - Knowledge of the effect that a loss or malfunction of <b>Static inverter</b> will have on the <b>UNITERRUPTABLE POWER SUPPLY System</b> .	2.7	<b>49</b>
263000 DC Electrical Distribution	X											<b>K1.02</b> - Knowledge of the physical connections and/or cause-effect relationships between <b>DC ELECTRICAL DISTRIBUTION SYSTEM</b> and <b>Battery charger and battery</b> .	3.2	<b>50</b>
264000 EDGs											X	<b>G2.2.39</b> - Knowledge of less than or equal to one hour Technical Specification action statements for systems, as they relate to EDGs.	3.9	<b>51</b>
300000 Instrument Air	X											<b>K1.04</b> - Knowledge of the physical connections and/or cause-effect relationships between <b>INSTRUMENT AIR SYSTEM</b> and Cooling water to compressor.	2.7	<b>52</b>
400000 Component Cooling Water											X	<b>G2.1.20</b> - Ability to interpret and execute procedure steps, as it relates to <b>COMPONENT COOLING WATER</b> .	4.6	<b>53</b>
K/A Category Point Totals:												Group Point Total:		<b>26/5</b>

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ES-401		BWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-1	
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic														
201002 RMCS											X	<b>G.2.1.32</b> – Ability to explain and apply system limits and precautions as they apply to RMCS.	3.8	<b>65</b>
201003 Control Rod and Drive Mechanism	X											<b>K1.01</b> - Knowledge of the physical connections and/or cause-effect relationships between CONTROL ROD AND DRIVE MECHANISM SYSTEM and Control rod drive hydraulic system.	3.2	<b>54</b>
201004 RSCS	N/A													
201005 RCIS	N/A													
201006 RWM														
202001 Recirculation						X						<b>K6.01</b> - Knowledge of the effect that a loss or malfunction of <b>Jet Pumps</b> will have on the RECIRCULATION System.	3.5	<b>55</b>
202002 Recirculation Flow Control										X		<b>A4.01</b> - Ability to manually operate and/or monitor in the control room: <b>MG sets</b> .	3.3	<b>56</b>
204000 RWCU														
214000 RPIS														
215001 Traversing In-core Probe						X						<b>K6.04</b> - Knowledge of the effect that a loss or malfunction of <b>Primary containment isolation system</b> will have on the TRAVERSING IN-CORE PROBE System.	3.1	<b>57</b>
215002 RBM						X						<b>K6.05</b> – Knowledge of the effect that a loss or malfunction an <b>LPRM detector(s)</b> will have on the ROD BLOCK MONITORING SYSTEM.	2.7	<b>58</b>
216000 Nuclear Boiler Inst.														
219000 RHR/LPCI: Torus/Pool Cooling Mode														
223001 Primary CTMT and Aux.					X							<b>K5.03</b> - Knowledge of the operational implications of <b>Down comer operation</b> as it applies to PRIMARY CONTAINMENT SYSTEM AND AUXILIARIES.	2.8	<b>59</b>

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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	#
226001 RHR/LPCI: CTMT Spray Mode												X G2.1.23 - Ability to perform specific system and integrated plant procedures during all modes of plant operation, as it relates to RHR/LPCI: CONTAINMENT SPRAY.	4.3	60
230000 RHR/LPCI: Torus/Pool Spray Mode														
233000 Fuel Pool Cooling/Cleanup														
234000 Fuel Handling Equipment												X G2.2.39 - Knowledge of less than or equal to one hour Technical Specification action statements for systems as they relate to FUEL HANDLING EQUIPMENT.	3.9	61
239001 Main and Reheat Steam	X											K1.08 - Knowledge of the physical connections and/or cause-effect relationships between MAIN AND REHEAT STEAM SYSTEM and Condenser air removal system.	2.9	62
239003 MSIV Leakage Control														
241000 Reactor/Turbine Pressure Regulator														
245000 Main Turbine Gen. / Aux.														
256000 Reactor Condensate														
259001 Reactor Feedwater														
268000 Radwaste														
271000 Offgas								X				A2.12 - Ability to (a) predict the impacts of Recombiner high temperature on the OFFGAS SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations:	2.7	64
272000 Radiation Monitoring														
286000 Fire Protection														
288000 Plant Ventilation												X A4.01 - Ability to manually operate and/or monitor in the control room: Start and stop fans	3.1	63
290001 Secondary CTMT														

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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	#
290003 Control Room HVAC														
290002 Reactor Vessel Internals														
K/A Category Point Totals:												Group Point Total:		<b>12/3</b>

## SRO Outline

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E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295001 Partial or Complete Loss of Forced Core Flow Circulation / 1 & 4						X	<b>A2.01</b> - Ability to determine and/or interpret <b>Power/flow map</b> as it applies to <b>PARTIAL OR COMPLETE LOSS OF FORCED CORE FLOW CIRCULATION</b> .	3.5	76
295003 Partial or Complete Loss of AC / 6									
295004 Partial or Total Loss of DC Pwr / 6									
295005 Main Turbine Generator Trip / 3						X	<b>A2.05</b> - Ability to determine and/or interpret <b>Reactor Power</b> as it applies to <b>MAIN TURBINE GENERATOR TRIP</b> .	3.9	77
295006 SCRAM / 1									
295016 Control Room Abandonment / 7						X	<b>G2.4.11</b> - Knowledge of abnormal condition procedures, as it relates to <b>CONTROL ROOM ABANDONMENT</b> .	4.2	78
295018 Partial or Total Loss of CCW / 8									
295019 Partial or Total Loss of Inst. Air / 8									
295021 Loss of Shutdown Cooling / 4						X	<b>G2.1.20</b> – Ability to interpret and execute procedure steps, as it relates to <b>LOSS OF SHUTDOWN COOLING</b> .	4.6	79
295023 Refueling Acc / 8									
295024 High Drywell Pressure / 5									
295025 High Reactor Pressure / 3						X	<b>A2.03</b> - Ability to determine and/or interpret <b>Suppression pool temperature</b> as it applies to <b>HIGH REACTOR PRESSURE</b> .	4.1	80
295026 Suppression Pool High Water Temp. / 5									
295027 High Containment Temperature / 5	N/A								
295028 High Drywell Temperature / 5									
295030 Low Suppression Pool Water Level / 5						X	<b>G2.4.18</b> - Knowledge of the specific bases for EOPs, as it relates to <b>LOW SUPPRESSION POOL WATER LEVEL</b> .	4.0	81
295031 Reactor Low Water Level / 2									

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295037 SCRAM Condition Present and Reactor Power Above APRM Downscale or Unknown / 1									
295038 High Off-site Release Rate / 9						X	<b>G2.4.6</b> - Knowledge of EOP mitigation strategies, as it relates to HIGH OFF-SITE RELEASE RATE.	4.7	<b>82</b>
600000 Plant Fire On Site / 8									
700000 Generator Voltage and Electric Grid Disturbances / 6									
<b>K/A Category Totals:</b>							<b>Group Point Total:</b>		<b>20/7</b>

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Form ES-401-1

E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
295002 Loss of Main Condenser Vacuum / 3									
295007 High Reactor Pressure / 3									
295008 High Reactor Water Level / 2									
295009 Low Reactor Water Level / 2						X	<b>G.2.4.6</b> - Knowledge of EOP mitigation strategies, as it relates to LOW REACTOR WATER LEVEL.	4.7	<b>83</b>
295010 High Drywell Pressure / 5									
295011 High Containment Temp / 5	N/A								
295012 High Drywell Temperature / 5									
295013 High Suppression Pool Temp. / 5									
295014 Inadvertent Reactivity Addition / 1									
295015 Incomplete SCRAM / 1									
295017 High Off-site Release Rate / 9									
295020 Inadvertent Cont. Isolation / 5 & 7						X	<b>G2.1.20</b> - Ability to interpret and execute procedure steps, as it relates to INADVERTENT CONTAINMENT ISOLATION.	4.6	<b>84</b>
295022 Loss of CRD Pumps / 1									
295029 High Suppression Pool Water Level / 5									
295032 High Secondary Containment Area Temperature / 5									
295033 High Secondary Containment Area Radiation Levels / 9									
295034 Secondary Containment Ventilation High Radiation / 9									
295035 Secondary Containment High Differential Pressure / 5									
295036 Secondary Containment High Sump/Area Water Level / 5					X		<b>A2.03</b> - Ability to determine and/or interpret Cause of the high water level as it applies to SECONDARY CONTAINMENT HIGH SUMP/AREA WATER LEVEL.	3.4	<b>85</b>

# SRO Outline

ES-401	BWR Examination Outline Emergency and Abnormal Plant Evolutions - Tier 1/Group 2 (RO / SRO)						Form ES-401-1		
E/APE # / Name / Safety Function	K 1	K 2	K 3	A 1	A 2	G	K/A Topic(s)	IR	#
500000 High CTMT Hydrogen Conc. / 5									
K/A Category Point Totals:							Group Point Total:		7/3

# SRO Outline

ES-401

4

Form ES-401-1

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	#
203000 RHR/LPCI: Injection Mode														
205000 Shutdown Cooling														
206000 HPCI								X				A2.08 - Ability to (a) predict the impacts of <b>High suppression pool temperature</b> on the HIGH PRESSURE COOLANT INJECTION SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations:	4.2	86
207000 Isolation (Emergency) Condenser	N/A													
209001 LPCS														
209002 HPCS	N/A													
211000 SLC														
212000 RPS											X	G2.4.11 – Knowledge of abnormal condition procedures, as they relate to REACTOR PROTECTION SYSTEM.	4.2	87
215003 IRM														
215004 Source Range Monitor														
215005 APRM / LPRM								X				A2.07 - Ability to (a) predict the impacts of <b>Recirculation flow channels flow mismatch</b> on the APRM / LPRM SYSTEM ; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations.	3.4	88
217000 RCIC														
218000 ADS														
223002 PCIS/Nuclear Steam Supply Shutoff								X				A2.02 - Ability to (a) predict the impacts of <b>D.C. electrical distribution failures</b> on the PCIS / NUCLEAR STEAM SUPPLY SHUTOFF SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations.	3.2	89
239002 SRVs														

# SRO Outline

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 1 (RO / SRO)										Form ES-401-1			
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	#
259002 Reactor Water Level Control														
261000 SGTS											X	<b>G2.2.39</b> - Knowledge of less than or equal to one hour Technical Specification action statements for systems. as it relates to STANDBY GAS TREATMENT SYSTEM.	4.7	<b>90</b>
262001 AC Electrical Distribution														
262002 UPS (AC/DC)														
263000 DC Electrical Distribution														
264000 EDGs														
300000 Instrument Air														
400000 Component Cooling Water														
<b>K/A Category Point Totals:</b>												<b>Group Point Total:</b>		<b>26/5</b>

# SRO Outline

ES-401

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Form ES-401-1

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)											Form ES-401-1		
System # / Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	IR	#
201001 CRD Hydraulic														
201002 RMCS														
201003 Control Rod and Drive Mechanism														
201004 RSCS	N/A													
201005 RCIS	N/A													
201006 RWM														
202001 Recirculation														
202002 Recirculation Flow Control														
204000 RWCU														
214000 RPIS														
215001 Traversing In-core Probe														
215002 RBM														
216000 Nuclear Boiler Inst.											x	G2.2.22 - Knowledge of limiting conditions for operations and safety limits, as it relates to NUCLEAR BOILER INSTRUMENTATION.	4.7	91
219000 RHR/LPCI: Torus/Pool Cooling Mode														
223001 Primary CTMT and Aux.														
226001 RHR/LPCI: CTMT Spray Mode														
230000 RHR/LPCI: Torus/Pool Spray Mode											x	G2.4.6 - Knowledge of EOP mitigation strategies as it relates to RHR/LPCI: TORUS/POOL SPRAY MODE.	4.4	92
233000 Fuel Pool Cooling/Cleanup														
234000 Fuel Handling Equipment														
239001 Main and Reheat Steam														
239003 MSIV Leakage Control	N/A													

# SRO Outline

ES-401	BWR Examination Outline Plant Systems - Tier 2/Group 2 (RO / SRO)										Form ES-401-1			
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	#
241000 Reactor/Turbine Pressure Regulator								X				A2.05 - Ability to (a) predict the impacts of <b>Failed open/closed main stop valve(s)</b> on the REACTOR/TURBINE PRESSURE REGULATING SYSTEM; and (b) based on those predictions, use procedures to correct, control, or mitigate the consequences of those abnormal conditions or operations.	3.9	93
245000 Main Turbine Gen. / Aux.														
256000 Reactor Condensate														
259001 Reactor Feedwater														
268000 Radwaste														
271000 Offgas														
272000 Radiation Monitoring														
286000 Fire Protection														
288000 Plant Ventilation														
290001 Secondary CTMT														
290003 Control Room HVAC														
290002 Reactor Vessel Internals														
<b>K/A Category Point Totals:</b>												<b>Group Point Total:</b>		12/3

## RO/SRO Generics

ES-401

### Generic Knowledge and Abilities Outline (Tier 3)

Form ES-401-3

Facility: <b>Limerick</b>		Date of Exam:					
Category	K/A #	Topic	RO		SRO-Only		
			IR	#	IR	#	
1. Conduct of Operations	2.1.44	Knowledge of RO duties in the control room during fuel handling such as responding to alarms from the fuel handling area, communication with the fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentation.	3.9	<b>66</b>			
	2.1.23	Ability to perform specific system and integrated plant procedures during all modes of plant operation.	4.3	<b>67</b>			
	<b>SRO Only</b>						
	2.1.37	Knowledge of procedures, guidelines, or limitations associated with reactivity management.			4.6	<b>94</b>	
	Subtotal			<b>2</b>		<b>1</b>	
2. Equipment Control	2.2.6	Knowledge of the process for making changes to procedures.	3.0	<b>68</b>			
	2.2.22	Knowledge of limiting conditions for operations and safety limits.	4.0	<b>69</b>			
	2.2.37	Ability to determine operability and/or availability of safety related equipment.	3.6	<b>70</b>			
	<b>SRO Only</b>						
	2.2.22	Knowledge of limiting conditions for operations and safety limits.			4.7	<b>95</b>	
	2.2.23	Ability to track Technical Specification limiting conditions for operations.			4.6	<b>96</b>	
	Subtotal			<b>3</b>		<b>2</b>	
3. Radiation Control	2.3.4	Knowledge of radiation exposure limits under normal or emergency conditions.	3.2	<b>71</b>			
	2.3.12	Knowledge of radiological safety principles pertaining to licensed operator duties, such as containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.	3.2	<b>72</b>			
	<b>SRO Only</b>						
	2.3.13	Knowledge of radiological safety procedures pertaining to licensed operator duties, such as response to radiation monitor alarms, containment entry requirements, fuel handling responsibilities, access to locked high-radiation areas, aligning filters, etc.			4.7	<b>97</b>	
	2.3.11	Ability to control radiation releases.			4.3	<b>98</b>	
	Subtotal			<b>2</b>		<b>2</b>	

## RO/SRO Generics

Facility: <b>Limerick</b>		Date of Exam:				
Category	K/A #	Topic	RO		SRO-Only	
			IR	#	IR	#
4. Emergency Procedures / Plan	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.	4.0	<b>73</b>		
	2.4.49	Knowledge of RO responsibilities in emergency plan implementation.	3.9	<b>74</b>		
	2.4.31	Knowledge of annunciator alarms, indications, or response procedures.	4.2	<b>75</b>		
	<b>SRO Only</b>					
	2.4.32	Knowledge of operator response to loss of all annunciators.			4.0	<b>99</b>
	2.4.28	Knowledge of procedures relating to a security event (non-safeguards information).			4.1	<b>100</b>
	Subtotal				3	2
Tier 3 Point Total				<b>10</b>		<b>7</b>

Facility: Limerick Units 1 & 2		Date of Examination: 10/20/2008
Examination Level: RO <input checked="" type="checkbox"/> SRO <input type="checkbox"/>		Operating Test Number: 1
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations A1-1	M, R	2.1.21 Prepare a Partial Procedure
Conduct of Operations A1-2	M, R	2.1.19 Evaluate Jet Pump Operability
Equipment Control A2	N, R	2.2.12 Perform Reactor Coolant Leakage Surveillance
Radiation Control A3	D, S	2.3.11 Offgas Effluent Dose Rate Determination
Emergency Procedures/Plan		
NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when all 5 are required.		
* Type Codes & Criteria: (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank ( $\leq 3$ for ROs; $\leq 4$ for SROs & RO retakes) (N)ew or (M)odified from bank ( $\geq 1$ ) (P)revious 2 exams ( $\leq 1$ ; randomly selected)		

Facility: Limerick Units 1 & 2		Date of Examination: 10/20/2008
Examination Level: RO <input type="checkbox"/> SRO <input checked="" type="checkbox"/>		Operating Test Number: 1
Administrative Topic (see Note)	Type Code*	Describe activity to be performed
Conduct of Operations A1-1	N, R	2.1.37 Authorize a Rx Maneuvering Shutdown Instruction (RMSI) Following a Rod Pattern Adjustment
Conduct of Operations A1-2	M, R	2.1.19 Evaluate Jet Pump Operability
Equipment Control A2	N, R	2.2.12 Review RHR Pump, Valve And Flow Test and Determine Required Actions
Radiation Control A3	N, R	2.3.6 Review and Approve a Liquid Rad Waste Discharge Permit
Emergency Procedures/Plan A4	M, R	2.4.41 Make E- Plan Classification, PAR and Recommendation to Issue KI
NOTE: All items (5 total) are required for SROs. RO applicants require only 4 items unless they are retaking only the administrative topics, when all 5 are required.		
* Type Codes & Criteria: (C)ontrol room, (S)imulator, or Class(R)oom (D)irect from bank ( $\leq 3$ for ROs; $\leq 4$ for SROs & RO retakes) (N)ew or (M)odified from bank ( $\geq 1$ ) (P)revious 2 exams ( $\leq 1$ ; randomly selected)		

Facility: Limerick 1 & 2		Date of Examination: 10/20/2008
Exam Level: RO <input checked="" type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input type="checkbox"/>		Operating Test No.: 1
Control Room Systems <sup>@</sup> (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)		
System / JPM Title	Type Code*	Safety Function
a. CRD Hydraulic System / Perform Reactor Startup	A, L, N, S	1
b. Low Pressure Core Spray / Manually Initiate Core Spray	A, L, M, P, EN, S	2
c. Main Steam / Open an MSIV	N, S	3
d. High Pressure Coolant Injection / Manually Start HPCI	A, M, S	4
e. RHR/LPCI: CS System Mode / Initiate Containment Spray	M, EN, S	5
f. AC Elect Dist / Transfer Loads to the Unit Aux Transformer	D, S	6
g. Component Cooling Water / Align RECW for Drywell Cooling	A, N, EN, S	8
h. Control Room Ventilation / High Radiation Isolation Reset	D, EN, S	9
In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Inventory Control / Alt Injection From Fire System	D, E, L, R	2
j. Low Pressure Coolant Injection / Transfer RWST to CST	N, E, L, R	4
k. D.C. Electrical Distribution / Supply Emer Power to RCIC Isolation	D, E, L, R	6
<p><sup>@</sup> All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.</p>		
* 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 (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		

Facility: Limerick 1 & 2		Date of Examination: 10/20/2008
Exam Level: RO <input type="checkbox"/> SRO-I <input checked="" type="checkbox"/> SRO-U <input type="checkbox"/>		Operating Test No.: 1
Control Room Systems <sup>@</sup> (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)		
System / JPM Title	Type Code*	Safety Function
a. CRD Hydraulic System / Perform Reactor Startup	A, L, N, S	1
b. Low Pressure Core Spray / Manually Initiate Core Spray	A, L, M, P, EN, S	2
c. Main Steam / Open an MSIV	N, S	3
d. High Pressure Coolant Injection / Manually Start HPCI	A, M, S	4
e. RHR/LPCI: CS System Mode / Initiate Containment Spray	M, EN, S	5
f.		
g. Component Cooling Water / Align RECW for Drywell Cooling	A, N, EN, S	8
h. Control Room Ventilation / High Radiation Isolation Reset	D, EN, S	9
In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i. Inventory Control / Alt Injection From Fire System	D, E, L, R	2
j. Low Pressure Coolant Injection / Transfer RWST to CST	N, E, L, R	4
k. D.C. Electrical Distribution / Supply Emer Power to RCIC Isolation	D, E, L, R	6
<p><sup>@</sup> All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.</p>		
* 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 (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		

Facility: Limerick 1 & 2		Date of Examination: 10/20/2008
Exam Level: RO <input type="checkbox"/> SRO-I <input type="checkbox"/> SRO-U <input checked="" type="checkbox"/>		Operating Test No.: 1
Control Room Systems <sup>@</sup> (8 for RO); (7 for SRO-I); (2 or 3 for SRO-U, including 1 ESF)		
System / JPM Title	Type Code*	Safety Function
a. CRD Hydraulic System / Perform Reactor Startup	A, L, N, S	1
b. Low Pressure Core Spray / Manually Initiate Core Spray	A, L, M, P, EN, S	2
c.		
d.		
e.		
f.		
g. Component Cooling Water / Align RECW for Drywell Cooling	A, N, EN, S	8
h.		
In-Plant Systems <sup>@</sup> (3 for RO); (3 for SRO-I); (3 or 2 for SRO-U)		
i.		
j. Low Pressure Coolant Injection / Transfer RWST to CST	N, E, L, R	4
k. D.C. Electrical Distribution / Supply Emer Power to RCIC Isolation	D, E, L, R	6
<p><sup>@</sup> All RO and SRO-I control room (and in-plant) systems must be different and serve different safety functions; all 5 SRO-U systems must serve different safety functions; in-plant systems and functions may overlap those tested in the control room.</p>		
* 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 (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		

Facility: Limerick 1 &amp; 2

Scenario No.: 1

Op-Test No.: 1

Examiners: \_\_\_\_\_

Operators: \_\_\_\_\_

## Initial Conditions:

100% power, EOL, Unit 2 in refueling, OPCON 5

## Turnover:

1A Drywell Chiller OOS for oil replacement, expected to be returned in 12 hours. D12 Diesel Generator running unloaded at rated speed for run-in following cylinder liner replacement. Synchronize and load D12 Diesel Generator per RT-6-092-312-1, D12 Diesel Generator Run-In, beginning at Step 4.5.28.

Event No.	Malf. No.	Event Type*	Event Description
1	N/A	N-BOP	Perform Loaded Run-In on D12 Diesel Generator
2	N/A	R-RO	100 MWe Load Reduction For Transmission Line Problem
3	MHP450	C-BOP, TS-SRO	HPCI Inadvertent Startup
4	MCN078C MRR507A	C-RO, TS-SRO	Condensate Pump C Trips, RRP A Fails to Runback
5	MPR020B	I-RO TS0SRO	APRM Channel 2 Fails to 96%
6	MRD016F MRP029C MRP407C MSL198A MSL196B MSL196C	M	2 Control Rods Scram, ATWS, 1A SLC Pump Loss of Control Power, B & C SLC Squib Valves Fail to Open
7	MEH104B OR Bkrs	M	Main Turbine Trip, Transfer Failure of Unit Aux Buses 11 and 12
8	MRC457B	I-BOP	RCIC Flow Controller Fails Low in Automatic
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor			

Facility: Limerick 1 & 2		Scenario No.: 2		Op-Test No.: 1	
Examiners: _____		Operators: _____			
_____		_____			
_____		_____			
Initial Conditions: Unit 1 at 90% power. Unit 2 is at 100% power.					
Turnover: 1A Drywell Chiller OOS for oil replacement, expected to be returned in 12 hours. Fuel handling is in progress in Unit 1 Spent Fuel Pool. Shift orders are to perform a rod pattern adjustment.					
Event No.	Malf. No.	Event Type*	Event Description		
1	MRD016E	C-RO TS-SRO	Control Rod 38-47 Drifts Out		
2	N/A	R-RO	Perform Rod Pattern Adjustment		
3	MCU195B MRP027B	C-RO C-BOP TS-SRO	RPS Channel B Breaker Trip, RWCU Fails to Isolate		
4	MRR433B MRR434B OR F023B	C-RO C-BOP	RRP 1B #1 Seal Failure, Followed By #2 Seal Failure, RRP Suction Valve Fails As-Is		
5	MMS067 MRR440A	M	Coolant Leak in Drywell		
6	MED261 MDG420A MED263C	M	Loss of Offsite Power, D11 Fails to Start and D13 Lockouts		
7	MHP447A MHP449	C-BOP	HPCI Aux Oil Pump Auto Start Failure and Turbine Trip Following Manual Start		
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor					

Facility: Limerick 1 & 2	Scenario No.: 3	Op-Test No.: 1	
Examiners: _____	Operators: _____	_____	
_____	_____	_____	
_____	_____	_____	
Initial Conditions: Unit 1 at 58% power. C RFP has been running at 2300 prm for 1.5 hours. Unit 2 is at 100% power.			
Turnover: 1A Drywell Chiller OOS for oil replacement, expected to be returned in 12 hours. Shift orders are to continue rod withdrawal per Sequence Step 32, Rod 54-39. GP-2 is complete through 3.5.33. Currently at Step 3.5.34. Raise power to > 60%, place the C RFP in service per S06.1.C and then continue the startup to 75% power.			
Event No.	Malf. No.	Event Type*	Event Description
1	N/A	R-RO	Raise Power to 75%
2	MRD016D	C-RO TS-SRO	Stuck Control Rod 06-23
3	NA	N-BOP	Start C Reactor Feed Pump
4	MED282C	C-BOP TS-SRO	Loss of Div III DC
5	MSW488C	C-BOP	Service Water Pump CTrip
6	MAD149E MRP029B	C-BOP C-RO	An SRV Fails Open, Manual Reactor Scram Requires ARI
7	MMS067	M	Instrument Line Break in Drywell
8	MPC257	M	RHR Pump Suppression Pool Suction Line Rupture
* (N)ormal, (R)eactivity, (I)nstrument, (C)omponent, (M)ajor			