

Commonwealth Edison Company  
Braidwood Generating Station  
Route #1, Box 84  
Braceville, IL 60407-9619  
Tel 815-458-2801



March 30, 1999

Mr. Hironori Peterson  
U. S. Nuclear Regulatory Commission  
Region III  
801 Warrenville Road  
Lisle, IL 60532-4351

Dear Mr. Peterson:

Enclosed is the integrated examination outline (written and operating test) which Braidwood Generating Station is submitting for review, comment, and approval for the initial License Examination scheduled for the week of June 7, 1999, at Braidwood Generating Station.

This outline has been developed in accordance with Interim Revision 8 of NUREG-1021 ("Operator Licensing Examiner Standards").

Please ensure that these materials are withheld from public disclosure until after the examinations are complete.

If you have any questions or concerns, regarding this outline, please contact Terrence Simpkin at (815) 458-2801 extension 2980.

Sincerely,

A handwritten signature in dark ink, appearing to read "T. J. Tulon", is written over the typed name.

Timothy J. Tulon  
Site Vice President  
Braidwood Nuclear Generating Station

TJT/NRC/99017jt.doc

No Enclosures

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PDR ADOCK 05000456  
V PDR

A Unicom Company

APR 01 1999

Facility:		Date of Examination:		
Item	Task Description	Initials		
		a	b	c
1. W R I T T E N	a. Verify that the outline(s) fit(s) the appropriate model per ES-401.	PLM	dt	AB
	b. Assess whether all six knowledge and four ability categories are appropriately sampled.	PLM	dt	AB
	c. Assess whether the outline over-emphasizes any systems, evolutions, or generic topics.	PLM	dt	AB
	d. Assess whether the repetition from previous examination outlines is excessive.	PLM	dt	AB
2. S I M	a. Using Form ES-301-5, verify that the proposed scenario sets cover the required number of normal evolutions, instrument and component failures, and major transients.	PLM	dt	AB
	b. Assess whether there are enough scenario sets (and spares) to test the projected number and mix of applicants in accordance with the expected crew composition and rotation schedule without compromising exam integrity; ensure each applicant can be tested using at least one new scenario and scenarios will not be repeated over successive days.	PLM	dt	AB
	c. To the extent possible, assess whether the outline(s) conform(s) with the qualitative and quantitative criteria specified on Form ES-301-4 and described in Appendix D.	PLM	dt	AB
3.  W / T	a. Verify that the outline(s) contain(s) the required number of control room and in-plant tasks and verify that no more than 30% of the test material is repeated from the last NRC examination.	PLM	dt	AB
	b. Verify that the tasks are distributed among the safety function groupings as specified in ES-301; one task shall require a low-power or shutdown condition, one or two shall require the applicant to implement an alternate path procedure, and one should require entry to the RCA.	PLM	dt	AB
	c. Verify that the required administrative topics are covered, with emphasis on performance-based activities.	PLM	dt	AB
	d. Determine if there are enough different outlines to test the projected number and mix of applicants and ensure that no more than 30% of the items are duplicated on successive days.	PLM	dt	AB
4. G E N  E  R  A  L	a. Assess whether plant-specific priorities (including PRA and IPE insights) are covered in the appropriate exam section.	PLM	dt	AB
	b. Assess whether the 10 CFR 55.41/43 and 55.45 sampling is appropriate.	PLM	dt	AB
	c. Ensure that K/A importance ratings (except for plant-specific priorities) are at least 2.5.	PLM	dt	AB
	d. Check for duplication and overlap among exam sections.	PLM	dt	AB
	e. Check the entire exam for balance of coverage.	PLM	dt	AB
	f. Assess whether the exam fits the appropriate job level (RO or SRO).	PLM	dt	AB
Printed Name / Signature		Date		
a. Author	DARIN MYERS / <i>Darin J. Myers</i>	3/29/99		
b. Facility Reviewer(*)	<i>David Hoots</i>	5/5/99		
c. Chief Examiner	<i>Howard Peterson</i>	4/2/99, 4/10/99, 4/16/99		
d. NRC Supervisor	<i>David E. Hill / David E. Hill</i>	5/1/99		
(*) Not applicable for NRC-developed examinations				

x further review after receiving ES-301-4

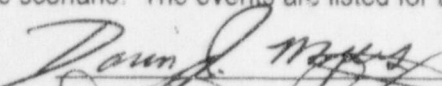
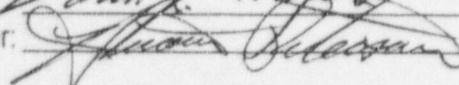
OPERATING TEST NO.: 1

Applicant Type	Evolution Type	Minimum Number	Scenario Number			
			1	2	3	4
RO	Reactivity	1	1/	2/	1/	1/
	Normal	1	1/1	1/2	1/1	1/1
	Instrument	2	3/4	4/3	4/2	2/3
	Component	2	2,7/5,7	1,7/1,6	7/3	4,7/8
	Major	1	6,8/6,8	5/5	5,6,8/5,6,8	5,6/5,6
As RO	Reactivity	1	1	2	1	1
	Normal	0				
	Instrument	1	3	4	4	2
	Component	1	2,7	1,7	7	4,7
	Major	1	6,8	5	5,6,8	5,6
SRO-I	Reactivity	0				
	Normal	1	1	2	1	1
	Instrument	1	3,4	3,4	2,4	2,3
	Component	1	2,5,7	1,6,7	3,7	4,7,8
	Major	1	6,8	5	5,6,8	5,6
SRO-U	Reactivity	0	N/A	N/A	N/A	N/A
	Normal	1	N/A	N/A	N/A	N/A
	Instrument	1	N/A	N/A	N/A	N/A
	Component	1	N/A	N/A	N/A	N/A
	Major	1	N/A	N/A	N/A	N/A

- Instructions: (1) Enter the operating test number and Form ES-D-1 event numbers for each evolution type.  
 (2) Reactivity manipulations must be significant as defined in Appendix D.

NOTE: Scenario Number 4 is a "spare" scenario and is represented for comparison purposes only in Examination Outline submittal.

The "/" in the cells for the "RO" applicant type represents the position the applicant is expected to fill during the scenario. The events are listed for the identified position: RO / BOP.

Author:   
 Chief Examiner: 



Operating Test: 1

Competencies	Applicant #1 RO/SRO-I/SRO-U				Applicant #2 RO/SRO-I/SRO-U				Applicant #3 RO(BOP)/SRO-I/SRO-U			
	SCENARIO				SCENARIO				SCENARIO			
	1	2	3	4	1	2	3	4	1	2	3	4
Understand and Interpret Annunciators and Alarms	3-8	1, 3-7	2-8	2-8	2-3, 6-8	1, 4-5,7	3-8	2, 4-7	4-8	1,3, 5-6	2, 5-8	3, 5-6,8
Diagnose Events and Conditions	2-8	1, 3-7	2-8	2-8	2-3, 6-8	1,4 5,7	3-8	2, 4-7	4-8	1-3, 5-6	2, 5-8	3, 5-6,8
Understand Plant and System Response	1-8	1-7	1-8	1-8	2-3, 6-8	1-2, 4-5,7	1, 3-8	1-2 4-7	1, 4-8	1-3, 5-6	1-2, 5-8	1,3, 5-6,8
Comply With and Use Procedures (1)	1-8	1-7	1-8	1-8	1,3 6-8	1-2, 4-5,7	1, 3-8	1-2 4-7	1, 4-8	1-3, 5-6	1-2, 5-8	1,3, 5-6,8
Operate Control Boards (2)	1-8	1-7	1-8	1-8	1,3,5 6-8	1-2, 4-5,7	1, 3-8	1-2 4-7	1, 4-8	1-3, 5-6	1-2, 4-6,8	1,3, 5-6,8
Communicate and Interact With the Crew	1-8	1-7	1-8	1-8	1-8	1-7	1-8	1-2, 4-8	1-8	1-7	1-8	1,3, 5-6,8
Demonstrate Supervisory Ability (3)	1-8	1-7	1-8	1-8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Comply With and Use Tech. Specs. (3)	3	1,4	2,3	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

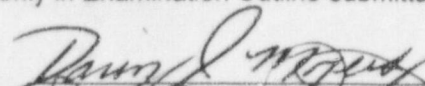
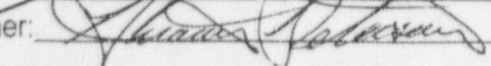
Notes:

- (1) Includes Technical Specification compliance for an RO.
- (2) Optional for an SRO-U.
- (3) Only applicable to SROs.

Instructions:

Circle the applicant's license type and enter the event numbers that test the competency for each scenario in the set.

NOTE: **OPERATING TEST NO.: 1.** Scenario Number 4 is a "spare" scenario and is represented for comparison purposes only in Examination Outline submittal. The order of listing for candidates is SRO, RO and BOP by position.

Author:   
 Chief Examiner: 





Simulation Facility BraidwoodScenario No.: 1-1Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Applicant: \_\_\_\_\_ SRO  
\_\_\_\_\_ RO  
\_\_\_\_\_ BOP

Objectives: To evaluate the applicants ability to use Normal, Abnormal, Emergency and alarm response procedures to conduct a normal ramp down of reactor power at 5 MW/min, to respond to a Thot instrument failing high coincident with control rod speed malfunction causing rods to move at 1 step/min when auto rod control is indicated, a failure of the feedwater header discharge pressure instrument, a Main Feedwater Pump speed control malfunction resulting in the pump tripping, and a loss of offsite power with no Emergency Diesel Generators available (loss of all AC power).

Initial Conditions: IC-54; 100% power BOL, Equil. Xenon,

Turnover: The Unit is at 100% power. Severe storm warnings are in effect. Circuit breaker 1423 (DG-1B feeder to bus 142) was declared OOS late last shift and is being replaced. DG-1B has been declared Out of Service. Directions have been received to lower power immediately to 60% at 5 MW/min.

Event No.	Malf. No.	Event Type*	Event Description
Preload	RFP EG09, MAINT_O		1B DG MAINT switch
Preload	FW01	C BOP SRO	1A Motor driven Feedwater Pump fails to start
1		N BOP SRO	Ramp down turbine power to 60% at 5 MW/min
		R RO	Lower reactor power using rods and/or boration
2	RD09, 1	C RO SRO	Rods move at 1 step/min. in AUTO
3	RX18L, 650	I RO SRO	Loop 4 Thot (#2 RTD) fails high
4	FW16, 1500, 30	I BOP SRO	FW Header Discharge Pressure PT-508 fails high on a 30 second ramp
5	FW06B (FW01)	C BOP SRO	1C Main Feedwater Pump speed control fails to minimum speed over two minutes
6	RFP IC03	M BOP RO SRO	Inadvertent turbine trip
7	ED15C	C BOP RO SRO	Loss of Offsite Power
8	EG08A	M BOP RO SRO	EDG1A fails 90 sec after start resulting in a loss of all AC power

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

## SCENARIO 1-1 OVERVIEW

Unit 1 is at 100% power, BOL. The System Operator has requested a ramp down of reactor power ASAP due to problems on the grid. It is desired that power be lowered at the rate of 5 MW/min.

Following clearly observable plant response from the reactivity changes, control rod speed unit will fail with rod speed at 1 step/min when automatic rod control is called for. Coincident with the rod speed failure, Loop 4 Thot fails high, resulting in demanded rod inward motion. It is expected that the RO will recognize improper rod motion for this condition and place rod control in manual. BwOA INST-2 (Attachment A) will be entered to address the failed Thot RTD. BwOA ROD-2 may be entered, but is NOT required, in response to the rod control problem. I&C will not be able to repair the rod speed problem and manual rod control will be the only way to move control rods at the proper speed. The SRO will address ITS for actions for the failed Thot instrument.

After the bistables for the failed Thot instrument are tripped, feedwater header pressure instrument, PT-508, will fail high. This results in a demanded decrease in main FW Pumps speed. The operator is expected to recognize this condition, take manual control of the Master FW Pumps Speed controller and restore FW discharge pressure to within its normal band. Once SG levels are stabilized, the 1C Main Feedwater Pump speed control will experience a reduction in speed due to a speed feedback error until the FW Pump turbine trips. The operator is expected to initiate a turbine runback when the 1A FW fails to start. The RO is expected to borate and drive rods in manual as necessary to restore Tave to Tref at final load.

Once the plant has stabilized, an inadvertent trip of the main turbine will occur. The crew will perform immediate actions of E-0 and transition will be made to ES-0.1. At step 9 of ES-0.1, a loss of all offsite power will occur due to weather conditions. The 1A DG will start and energize ESF Bus 141. Approximately 90 seconds later, the 1A DG will trip resulting in a loss of all AC power to the unit. Transition will be made to ECA-0.0. The scenario ends following energization of the ESF bus 141 from the crosstie to Unit 2 and restoration of charging flow.

### Critical Tasks

1. E-0 — C: Energize at least one AC Emergency Bus before transition out of E-0, unless the transition is to ECA-0.0, in which case the critical task must be performed before placing safeguards equipment handswitches in pull-to-lock position.
2. ECA-0.0 — H: Isolate RCP seal injection before a charging pump starts or is started.



Simulation Facility BraidwoodScenario No.: 1-2Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Applicant: \_\_\_\_\_ SRO  
\_\_\_\_\_ RO  
\_\_\_\_\_ BOP

Objectives: To evaluate the applicants ability to use Normal, Abnormal, Emergency and alarm response procedures to respond to a small SGTL, a power reduction, an unstable SG level controller, a N44 power range failure, a non-isolable Steam Break with a SGTR, a failure of the turbine to trip automatically, and an SI pump that fails to start on SI.

Initial Conditions: IC-22; 100% power MOL, Equil. Xe

Turnover: The unit is at 100% power. Circuit breaker 1423 (DG-1B feeder to bus 142) was declared OOS late last shift and is being replaced. DG-1B has been declared Out of Service.

Event No.	Malf. No.	Event Type*	Event Description
Preload	RP14A SI01B RF RP35, OUT RF RP61, OUT MS01B, 90 TC03 IOR ZD1HHSTG010 1 NORM		"A" Train SI fails to actuate "B" Train SI Pump trips Failure of MSIV auto closure, failure of closure on MSLI signal 1B MSIV fails open at 90% Turbine fails to trip on reactor trip ( manual runback desired) Override Turbine TRIP pushbutton
1	TH03B, 25	C BOP RO SRO	Steam Generator B tube leak – small (25 gpm)
2		N BOP SRO	Ramp down turbine power at directed MW/min due to tube leak
		R RO	Lower reactor power using rods and/or boration
3	RX02B, 3	I BOP SRO	S/G B unstable level controller -- 15% on 3 min cycle
4	NI09D, 120	I RO SRO	Power Range N44 fails high
5	MS08B, 2MLB TH03B, 1000 (RF RP35/61) (MS01B)	M BOP RO SRO	Non-isolable Steam Break outside containment of 2 MLB over 60 sec S/G Tube leak increases on reactor trip (All MSIVs fail to auto close and 1B MSIV fails at 90% open)
6	(TC03) (IOR ZD1HHSTG010)	C BOP SRO	On reactor trip, turbine fails to AUTO/MAN trip and must be manually runback.
7	(SI01B) (RP14A)	C RO SRO	On SI, the "B" Train SI Pump fails to start and the "A" train equipment fails to start and must be manually started.

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

## SCENARIO 1-2 OVERVIEW

Unit 1 is at 100 % power. Following turnover, the crew is to maintain power steady for flux mapping. Shortly after turnover a SGTL will be initiated. It is desired that the leak be large enough to cause the operators to initiate a power reduction but small enough that a reactor trip will not be called for. BwOA PRI-1 may be entered in response to the RCS leakage. Once the leakage is determined to be SG tube leakage, BwOA SEC-8 will be entered. The crew will be directed to initiate a Unit shutdown within 6 hours based on the determined leak rate.

Following clearly observable plant response from the reactivity changes, SG level controller for the leaking SG will become unstable. The operator will determine the FRV is oscillating and place the controller in manual to control SG level. Manual control will be required during any subsequent power reduction.

After i&C has been contacted to repair the SG level controller, a failure high of power range channel N44 will occur. Entry is made into BwOA INST-1. Rods will be placed in manual, the channel will be placed in a tripped condition, and rods returned to automatic. The SRO will review ITS for the failed NI applicability and the tripping of bistables.

After the bistables are tripped for the failed NI channel, a non-isolable steam break outside containment will occur. A manual reactor trip is expected with the turbine failing to trip. The operator is expected to manually runback the turbine. When the reactor is tripped, the 1B SG tube leak will increase to a tube rupture over 10 minutes. All MSIVs will remain open due to a failure of the automatic steamline isolation circuit. When the MSIVs are manually closed, the MSIV for 1B SG will fail at the 90% open position. Upon actuation of SI, the "A" Train SI signal fails requiring manual operation of the required equipment. Additionally, the "B" Train SI pump will fail to start or run. Following completion of the appropriate steps of E-0 transition should be made to E-2 and then to E-3. When it is determined that the ruptured SG pressure is either < 320 psig OR that the ruptured SG pressure is < 250 psig above the intact SG pressure (following cooldown), transition is made to ECA-3.1. The scenario terminates after determination that no additional cooldown is required at step 10 of ECA-3.1.

### Critical Tasks

1. E-0 — J: Establish flow from at least on intermediate-head ECCS pump before transition out of E-0.
2. E-2 — A: Isolate the faulted SG before transition out of E-2.
3. E-3 — A: Isolate feedwater flow into and steam flow from the ruptured SG before a transition to ECA-3.1 occurs.



Simulation Facility BraidwoodScenario No.: 1-3Examiners: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Applicant: \_\_\_\_\_ SRO  
\_\_\_\_\_ RO  
\_\_\_\_\_ BOP

Objectives: To evaluate the applicants ability to use Normal, Abnormal, Emergency and alarm response procedures to respond to a normal power increase, a SG pressure channel failure, an ECCS Accumulator water leak, a VCT level transmitter failure with the pre-loaded condition of the other channel OOS for I&C work, an inadvertent SI with a PORV failing open and with failure of the reactor trip breakers RTB A&B failing to open in auto OR manual from the control room, and a RCS LOCA.

Initial Conditions: IC-18; 74% power MOL. Equil. Xe.

Turnover: I&C is performing surveillance testing on ESFAS Train A. I&C has VCT level transmitter LT-112 deenergized for repairs. Circuit breaker 1423 (DG-1B feeder to bus 142) was declared OOS late last shift and is being replaced. DG-1B has been declared Out of Service.

Event No.	Malf. No.	Event Type*	Event Description
Preload	RP02A, B	M RO BOP	Failure of RTB A&B to auto AND Manual open. (can be opened locally)
	CV16, 0	SRO	VCT level LT-112 failed low. (deenergized)
1		N BOP SRO	Ramp up turbine power to 100% at directed MW/min
		R RO	Raise reactor power using rods and/or dilution
2	RX01A, 0, 60	I BOP SRO	1A SG pressure channel PT-514 fails low
3	SI11A, 20-100, 300	C BOP SRO	ECCS Accumulator A water leak - 20 gpm (ramp to 100 gpm over 5 min.)
4	CV17, 0	I RO SRO	VCT level transmitter LT-185 fails low
5	RP24A	M RO BOP SRO	Inadvertent SI
6	(RP02)	M RO BOP SRO	Reactor trip breakers fail to open
7	TH11B, 100	C RO SRO	RY-456 PORV fails open
8	TH05C, 4000	M BOP RO SRO	RCS leak, to be inserted after SI has been reset.

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



## SCENARIO 1-3 OVERVIEW

The Unit is at 75% power. 1B Emergency Diesel Generator is OOS. Power is to be increased at direction of the System Operator using normal procedures.

Following clearly observable plant response from the reactivity changes, the controlling pressure channel for 1A SG will fail low. The operator will take manual control of 1A SG FRV and control SG levels. Following entry into BwOA-INST-2(Attachment F), the operator will select the alternate channel for SG level control and place the FRV back in automatic. The SRO will review ITS and direct tripping of associated bistables.

After the power increase is resumed, a water leak on the 1A ECCS accumulator will occur. The crew may enter OA PRI-1 until accumulator level alarms occur. The leak will increase from 20 gpm to 100 gpm over a 5 minute period. The operator will attempt a refill of the accumulator using the system operating procedures. The SRO will review ITS for applicability and actions.

After the attempt is made to fill the accumulator, VCT level transmitter LT-185 will fail low. It should be recognized that I&C has been working on LT-112. The swapper to the RWST suction for the charging pumps will occur. I&C should be contacted for repairs on both the channels.

Following the decision for Unit shutdown or trip, an inadvertent SI signal is generated. E-0 should be entered and FR-S.1 entered when the reactor trip breakers will not open. Also, PORV 1RY456 will open in response to the RCS pressure rise and fail to reclose when pressure falls. The operator will be required to close the associated PORV Isolation valve 1RY8000A.

After ES-1.1 has been entered, a RCS LOCA of 4000 gpm occurs. The scenario ends following RCS cooldown evaluation at step 6 of ES-1.2.

### Critical Tasks

1. FR-S.1 — C: Insert negative reactivity into the core by at least one of the following methods before completing immediate action steps of FR-S.1: • De-energize the control rod drive MG sets; • Insert RCCAs; • Establish emergency boration flow to the RCS.
2. E-0 — M: Close the block MOV upstream of the stuck-open PZR PORV by completion of the first step in the ERG network that directs the crew to close the block MOV.

Simulation Facility BraidwoodScenario No.: SpareExaminers: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_Operators: \_\_\_\_\_ SRO  
\_\_\_\_\_ RO  
\_\_\_\_\_ BOP

Objectives: To evaluate the applicants ability to use Normal, Abnormal, Emergency and alarm response procedures to respond to a normal power increase, a pressurizer level channel failure, HDT level controller failure, a leak in the letdown heat exchanger with failure of the letdown pressure control valve closed, a leak in the main turbine EHC system and a Large LOCA with failure of RH pumps to start and failure of automatic transfer to sump suction for operating train of RH.

Initial Conditions: IC-16. Unit at 49% power

Turnover: Circuit breaker 1423 (DG-1B feeder to bus 142) was declared OOS late last shift and is being replaced. DG-1B has been declared Out of Service

Event No.	Malf. No.	Event Type*	Event Description
Preload	RH01A	C RO SRO	1A RH Pump fails to start/trip
Preload (PL2)	MRF RP85 open RP15F	C RO SRO	1B RH Pump fails to start on SI with manual start available
Preload (PL3)	RH04B	C BOP SRO	Failure of 1SI8811B (RH CNMT Sump) auto transfer
1		N BOP SRO	Ramp up turbine power to 75% at 5 MW/min
		R RO	Raise reactor power using rods and/or dilution
2	RX13A, 0, 10	I RO SRO	Pressurizer level channel fails low
3	FW17, 0	I BOP SRO	Heater Drain Tank level controller fails low
4	CV23A, 100 RF CV01, 0%	C RO SRO	Letdown Heat Exchanger tube leak w/PCV-131 fails closed (mechanical binding)
5	TC15, 34	M BOP RO SRO	EHC System leak of 24 gpm results in turbine trip
6	TH06A, 450000	M BOP RO SRO	Large Break LOCA upon reactor trip
7	(RH01A) (PL2)	C RO SRO	1A and 1B RH Pump fail to start with 1B RH pump manual start capable.
8	(PL3)	C BOP SRO	Failure of Auto transfer to cold leg recirc for "B" Train

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

## SCENARIO Spare OVERVIEW

Unit 1 is at 50% power. Following turnover power increase is initiated to 75% power.

Following clearly observable plant response from the reactivity changes, the controlling pressurizer level channel will fail low. Pressurizer level will be placed in manual, an operable channel selected and level returned to normal. The SRO should contact I&C to assist in repair and the tripping of bistables. Technical Specifications should be consulted for applicability.

After the bistables for pressurizer level have been tripped, Heater Drain Tank level controller will fail causing heater drain tank level to rise. The overflow valve will open and level alarms will actuate. The operator is expected to take manual control of the level controller and reopen the valve.

After HDT tank level is restored to normal band, a leak will develop in the letdown heat exchanger and when the heat exchanger is isolated, PCV-131 will fail closed. The operator should notice VCT level changing, and radiation levels in the CCW system increasing. Operators should troubleshoot and identify the failed letdown HX. When letdown is established using the 1B letdown heat exchanger, the crew should identify the failed PCV-131 valve and establish excess letdown.

After excess letdown is established, an EHC leak will develop on the EHC reservoir. EHC level will drop bringing in several alarms. When level is sufficiently low to result in a trip of the EHC pumps, the main turbine also gets a trip signal. E-0 will be entered when the reactor trips.

At the time of the reactor trip, a large break LOCA occurs on the RCS. Both RH pumps fail to start. The 1A RH pump trips if a manual start is attempted, but the 1B RH pump will start on a manual start. When RWST level drops to the LO-2 level for automatic transfer to the CNMT sump suction, the "B" Train valve SI8811B will fail to automatically open. Operator action is required to stop the RH and CS pumps and manually open the sump suction valves. The scenario is terminated following completion of the alignment of ECCS for cold leg recirculation.

### Critical Tasks

1. E-0 — H: Manually start at least one low-head ECCS pump before transition out of E-0.
2. ES-1.3 — A: Transfer to cold leg recirculation and establish ECCS recirculation flow that at least meets the assumptions of the plant-specific LOCA analysis.



Facility: Braidwood  
 Examination Level: SRO

Date of Examination: 06/07/97  
 Operating Test Number: 1

System / JPM Title / Type Codes*	Safety Function	Planned Followup Questions: K/A/G – Importance - Description
1. Pzr Pressure Control / Respond to Failed Pzr Spray Valve N A S	3	a. 010 K1.03 3.6/3.7 Spray valve effectiveness dependence on RCP
		b. 010 A2.03 4.1/4.2 Difference in plant response if PORV failed open
2. Containment Spray / Align Containment Spray for Recirculation - Failure N A S	5	a. 026 A2.03 4.1/4.4 Actions if CS-007 valve failed to open, CS pump running
		b. 026 K4.02 3.1/3.6 Significance of RWST LEVEL LO-3
3. CVCS-RMS / Perform an emergency boration - Failure N A S	1	a. 004 A4.12 3.8/3.3 Determine the setting for the BA flow controller for the RCS boron concentration following boration
		b. 004 A2.14 3.8*/3.9 How many gallons of boron would be required to complete 58 ppm change
4. Main Steam / Opening the Main Steam Isolation Valves [N-14] D S L	4	a. 039 2.1.12 2.9/4.0 ITS response to failure of MSIV
		b. 039 A106 3.0/3.1 What causes MSIV closure when SG pressure falls from normal pressure to 940 psig
5. SI Accumulator / Lower SI Accumulator Level - Mode 4 N S L	2	a. 006 2.2.22 3.4/4.1 Technical Specification REQ ACTION for closed SI Accumulator Isol Valve when at power
		b. 006 K5.02 2.8/2.9 Effect of failure to lower level to within operating band before pressurizing SI Accumulator
6. Essential Service Water / Swap SW Pumps N S	8	a. 076 2.1.33 3.4/4.0 Cross Unit SX pump operability requirements
		b. 076 2.1.24 2.8/3.1 SX Pump start interlocks
7. CETC Instruments / Test the CETC [N-65] D C	7	a. 017 A2.01 3.1/3.5 Response of single CETC failure
		b. 017 2.2.22 3.4/4.1 Actions for CETC failures
8. Main Steam / Local Operation of a SG PORV [N-83] D P	4	a. 039 2.1.30 3.9/3.4 Operation from RSDP
		b. 002 K5.09 3.7/4.2 Evaluation of cooldown limits
9. ESFAS Instrumentation / Local Reset of FW Isolation Signal [N-91] D P	2	a. 013 K4.13 3.7/3.9 FW Isolation reset from control room post trip
		b. 013 A3.02 4.1/4.2 System response to HI-HI SG level
10. Containment Post LOCA Purge / Adjust Post LOCA Purge Flow N P R	5	a. 028 A4.01 4.0*/4.0* Operation of Post LOCA Purge Unit Filter Deluge
		b. 028 A1.01 3.4*/3.7* Hydrogen concentration affect on H2 control

Type Codes: (D) Direct from bank, (M)odified from bank, (N)ew, (A)lternate Path, (C)ontrol Room, (S)imulator, (P)lant, (L)ow Power, (R)CA

Facility: Braidwood  
 Examination Level: RO

Date of Examination: 06/07/97  
 Operating Test Number: 1

System / JPM Title / Type Codes*	Safety Function	Planned Followup Questions: K/A/G – Importance – Description
1. Pzr Pressure Control / Response to Failed Pzr Spray Valve N A S	3	a. 010 K1.03 3.6/3.7 Spray valve effectiveness dependence on RCP b. 010 A2.03 4.1/4.2 Difference in plant response if PORV failed open
2. Containment Spray / Align Containment Spray for Recirculation - Failure N A S	5	a. 026 A2.03 4.1/4.4 Actions if CS-007 valve failed to open, CS pump running b. 026 K4.02 3.1/3.6 Significance of RWST LEVEL LO-3
3. CVCS-RMS / Perform an emergency boration - Failure N A S	1	a. 004 A4.12 3.8/3.3 Determine the setting for the BA flow controller for the RCS boron concentration following boration b. 004 A2.14 3.8*/3.9 How many gallons of boron would be required to complete 58 ppm change
4. Main Steam / Opening the Main Steam Isolation Valves [N-14] D S L	4	a. 039 K4.08 3.3/3.4 Difference between manual & auto steamline isolation actuation b. 039 A106 3.0/3.1 What causes MSIV closure when SG pressure falls from normal pressure to 940 psig
5. SI Accumulator / Lower SI Accumulator Level - Mode 4 N S L	2	a. 006 2.2.22 3.4/4.1 Technical Specification REQ ACTION for closed SI Accumulator Isol Valve when at power b. 006 K5.02 2.8/2.9 Effect of failure to lower level to within operating band before pressurizing SI Accumulator
6. Essential Service Water / Swap SW Pumps N S	8	a. 076 2.1.32 3.4/3.8 RCFC operation with single SX pump b. 076 2.1.24 2.8/3.1 SX Pump start interlocks
7. CETC Instruments / Test the CETC [N-65] D C	7	a. 017 A2.01 3.1/3.5 Response of single CETC failure b. 017 K4.01 3.4/3.7 Effect of lowering CNMT pressure on Core Subcooling display
8. Main Steam / Local Operation of a SG PORV [N-83] D P	4	a. 039 2.1.30 3.9/3.4 Operation from RSDP b. 002 K5.09 3.7/4.2 Evaluation of cooldown limits
9. ESFAS Instrumentation / Local Reset of FW Isolation Signal [N-91] D P	2	a. 013 K4.13 3.7/3.9 FW Isolation reset from control room post trip b. 013 A3.02 4.1/4.2 System response to HI-HI SG level
10. Containment Post LOCA Purge / Adjust Post LOCA Purge Flow N P R	5	a. 028 A4.01 4.0*/4.0* Operation of Post LOCA Purge Unit Filter Deluge b. 028 A1.01 3.4*/3.7* Hydrogen concentration affect on H2 control
Type Codes: (D) Direct from bank, (M)odified from bank, (N)ew, (A)lternate Path, (C)ontrol Room, (S)imulator, (P)lant, (L)ow Power, (R)CA		

## JPM INFO

- JPM 1 - Normal 100% power operation. After position assumed, fail Pzr spray valve RY455C to 25 % open position. BwAR 1-12-C1. (Ref 1BwOA INST-2 Attachment B Step 2.b RNO).
- JPM 2 - Post LOCA conditions with ECCS aligned in Recirculation Mode, CS pumps running. RWST level just above 8%(<12%). Step 9 of 1BwEP ES-1.3.
- JPMs 3 & 4 - Mode 3 NOP NOT. MSIVs and Bypass MSIVs closed.  
JPM-3: BwOA PRI-2. Setup with valve on emergency boration line provides < 30 gpm BA flow indication.  
JPM-4: Section F of BwOP MS-9.
- JPMs 5&6 - Mode 4, 350°F. RHR shutdown. SI Accumulator A level at 63% and pressure at 50 psig. SX valve 1SX016B RCFC 1B & D Inlet valve closed  
JPM-5: Section F.3 of BwOP SI-6.  
JPM-6: BwOP SX-7.
- JPM-7: In the main Control Room at the plant. Section F.7 of BwOP RC-12.
- JPM 8 - BwOP MS-6, directed to open the \_A SG PORV (HOV-MS018A) 25% locally.
- JPM 9 - BwFR-H.1 Step 5.d RNO & 5.h., deenergize FWI signal at Aux Safeguard Relay Cabinet \_PA28J.
- JPM 10 - BwOP VQ-7, Section F.4, startup and adjust flow for Post LOCA Purge.



Facility: Braidwood 1 & 2		Date of Examination: 06/07/99
Examination Level: SRO		Operating Test Number: 1
Administrative Topic/Subject Description		Describe method of evaluation: 1. ONE Administrative JPM, OR 2. TWO Administrative Questions
A1	Conduct of Operations / Plant Parameter Verification - Review of Calorimetric [N-08 m.c.1]	1. JPM K/A 2.1.7 3.7/4.4
	Conduct of Operations / Fuel Handling	1. JPM K/A 2.3.2 3.5/3.3
A2	Equipment Control / Complete Documentation for a Temporary Alteration [S-01]	1. JPM K/A 2.2.14 2.1/3.0
A.3	Radiation Control / Review Radwaste Liquid Release Form	1. JPM K/A 2.3.6 2.1/3.1
A.4	Emergency Plan / Emergency Classification and Protective Actions	1. JPM K/A 2.4.41 2.3/4.1, 2.4.44 2.1/4.0

Facility: Braidwood 1 & 2		Date of Examination: 06/07/99
Examination Level: RO		Operating Test Number: 1
Administrative Topic/Subject Description		Describe method of evaluation: 3. ONE Administrative JPM, OR 4. TWO Administrative Questions
A1	Conduct of Operations / Plant Parameter Verification - Perform Calorimetric Using Process Plant Computer [N-08]	1. JPM K/A 2.1.19 3.0/3.0
	Conduct of Operations / Fuel Handling	1. JPM K/A 2.2.32 3.5/3.3
A2	Equipment Control / Replace Control Panel Lamp	1. JPM K/A 2.1.30 3.9/3.4
A.3	Radiation Control / Perform a Radwaste Liquid Release [N-32]	1. JPM K/A 2.3.11 2.7/3.2
A.4	Emergency Plan / E-Plan questions	2. Q1 K/A 2.4.39 3.3/3.1 Escort duty responsibility
		2. Q2 K/A 2.4.29 2.6/4.0 When is site assembly & accountability required

Admin Section Comments

SRO

- A.1.1 - Evaluation of BwOS 3.1.1-2 Calorimetric with error
- A.1.2 - Update the tracking fuel movement from core location to SFP location. BwAP 370-3, BwAP 370-3A12.
- A.2. - Complete required documentation of NSWP-A-21 (used to be BwAP 2321-18T1 & 2321-18T7)
- A.3 - Review LIQUID RELEASE TANK 0WX01T RELEASE FORM with error. BwOP WX-501T1 section E
- A.4 - Perform classification & recommend PARs for given conditions.

RO

- A.1.1 - Complete BwOS 3.1.1-2 Calorimetric
- A.1.2 - Update the tracking fuel movement from core location to SFP location. BwAP 370-3, BwAP 370-3A12.
- A.2. - Replace light bulb for Reactor Trip Bypass Breaker position. BwAP 350-4 & 350-4A1.
- A.3 - Perform steps for radwaste release using LIQUID RELEASE TANK 0WX01T RELEASE FORM . BwOP WX-501T1 section E
- A.4 - Questions for topic given (Note: Q1 was also asked on '97 Admin exam)
  - Q1 - BwZP 2000-10
  - Q2 - BwZP 2000-10



Facility		Braidwood		Date of Exam: 06/07/99				Exam Level: SRO					
Tier	Group	K/A Category Points											Point Total
		K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	
1. Emergency & Abnormal Plant Evolutions	1	3	2	5				4	6			4	24
	2			2				6	7			1	16
	3		1					1	1				3
	Tier Totals	3	3	7				11	14			5	43
2. Plant Systems	1	2	1	1	1	1	1	2	3	2	2	3	19
	2	1	1	1	2	1	1	2	4	1		3	17
	3		1			1			1	1			4
	Tier Totals	3	3	2	3	3	2	4	8	4	2	6	40
3. Generic Knowledge and Abilities					Cat 1		Cat 2		Cat 3		Cat 4		
					5		5		2		5		17

- Note:
- Attempt to distribute topics among all K/A Categories: select at least one topic from every K/A category within each tier.
  - Actual point totals must match those specified in the table.
  - Select topics from many systems: avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
  - Systems/evolutions within each group are identified on the associated outline.
  - The shaded areas are not applicable to the category/tier.

PWR SRO Examination Outline  
Emergency and Abnormal Plant Evolutions - Tier 1/Group 1

Number#	Name	K1	K2	K3	A1	A2	A3	G	K/A Topic(s)	Imp.	Pts.
001	Continuous Rod Withdrawal					X			AA2.05 Uncontrolled rod withdrawal, from available indications	4.6	1
003	Dropped Control Rod					X			AA2.02 Signal inputs to rod control system	2.8	1
005	Inoperable/Stuck Control Rod										
011	Large Break LOCA				X				EA1.11 Long-term cooling of core	4.2	1
011	Large Break LOCA					X			EA2.13 Difference between overcooling and LOCA indications	3.7*	1
011	Large Break LOCA			X					EK3.12 Actions contained in EOP for emergency LOCA (large break)	4.6	1
015	Reactor Coolant Pump Malfunctions										
017	Reactor Coolant Pump Malfunctions (Loss of RC Flow)										
024	Emergency Boration			X					AK3.02 Actions contained in EOP for emergency boration	4.4	1
024	Emergency Boration				X				AA1.23 CVCS centrifugal charging pump switches and indicators	3.3*	1
024	Emergency Boration					X			AA2.01 Whether boron flow and/or MOVs are malfunctioning, from plant conditions	4.1	1
026	Loss of Component Cooling Water					X			AA2.01 Location of a leak in the SWS	3.5	1
029	Anticipated Transient Without Scram						X		2.4.1 Knowledge of EOP entry conditions and immediate action steps.	4.6	1
029	Anticipated Transient Without Scram								2.4.48 Ability to interpret control room indications to verify the status and operation of system, and understand how operator actions and directives affect plant and system conditions.	3.8	1
029	Anticipated Transient Without Scram			X					AK3.12 Actions contained in EOP for ATWS	4.7	1
040	Steam Line Rupture		X						AK1.06 High-energy steam line break considerations	3.8	1
040	Steam Line Rupture			X					AK3.04 Actions contained in EOPs for steam line rupture	4.7	1
051	Loss of Condenser Vacuum										
055	Station Blackout							X	2.4.7 Knowledge of event based EOP mitigation strategies.	3.8	1
057	Loss of Vital AC Instrument Bus										
059	Accidental Liquid Radwaste Release										
062	Loss of Nuclear Service Water										
067	Plant Fire on Site										
068	Control Room Evacuation				X				AA1.21 Transfer of controls from control room to shutdown panel or local control	4.1	1
068	Control Room Evacuation					X			AA2.09 Saturation margin	4.3	1
069	Loss of Containment Integrity						X		2.2.22 Knowledge of limiting conditions for operations and safety limits.	4.1	1
074	Inadequate Core Cooling				X				EA1.06 RCPS	3.9	1
076	High Reactor Coolant Activity										

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1

Number#	Name	K/A Topic(s)										Imp.	Pts.			
		K1	K2	K3	A1	A2	A3	A4	A5	A6	A7			A8		
E02	SI Termination		X											3.9	1	
E04	LOCA Outside Containment	X												4.2	1	
E06	Degraded Core Cooling															
E07	Saturated Core Cooling															
E08	Pressurized Thermal Shock		X											4.0	1	
E09	Natural Circulation Operations			X										3.6	1	
E10	Natural Circulation with Steam Void in Vessel with/without RVLIS	X												3.6	1	
E12	Uncontrolled Depressurization of all Steam Generators															
E14	High Containment Pressure															
K/A Category Point Totals:		3	2	5	4	6	4	Group Point Total:								24



ES-401

PWR SRO Examination Outline  
Emergency and Abnormal Plant Evolutions - Tier 1/Group 2

ES-401-3

Number#	Name	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Pts.
007	Reactor Trip				X			EA1.03 RCS pressure and temperature	4.1	1
008	Pressurizer Vapor Space Accident									
009	Small Break LOCA				X			EA1.10 Safety parameter display system	3.9*	1
009	Small Break LOCA					X		EA2.01 Actions to be taken, based on RCS temperature and pressure, saturated and superheated	4.8	1
022	Loss of Reactor Coolant Makeup				X			AA1.08 VCT level	3.3	1
025	Loss of Residual Heat Removal System			X				AK3.01 Shift to alternate flowpath	3.4	1
027	Pressurizer Pressure Control Malfunction				X			AA1.01 PZR heaters, sprays, and PORVs	3.9	1
027	Pressurizer Pressure Control Malfunction					X		AA2.03 Effects of RCS pressure changes on key components in plant	3.4	1
032	Loss of Source Range Nuclear Instrumentation				X			AA1.01 Manual restoration of power	3.4*	1
032	Loss of Source Range Nuclear Instrumentation					X		AA2.04 Satisfactory source-range/intermediate-range overlap	3.5	1
033	Loss of Intermediate Range Nuclear Instrumentation						X	2.1.1 Knowledge of conduct of operations requirements.	3.8	1
037	Steam Generator Tube Leak				X			AA2.01 Unusual readings of the monitors; steps needed to verify readings	3.4	1
038	Steam Generator Tube Rupture				X			EA2.15 Pressure at which to maintain RCS during S/G cooldown	4.4	1
038	Steam Generator Tube Rupture			X				EK3.06 Actions contained in EOP for RCS water inventory balance, S/G tube rupture, and plant shutdown procedures	4.5	1
054	Loss of Main Feedwater									
058	Loss of DC Power									
060	Accidental Gaseous Radwaste Release									
061	Area Radiation Monitoring System Alarms									
065	Loss of Instrument Air					X		AA2.08 Failure modes of air-operated equipment	3.3	1
E03	LOCA Cooldown and Depressurization				X			EA1.3 Desired operating results during abnormal and emergency situations.	4.1	1
E05	Loss of Secondary Heat Sink									
E11	Loss of Emergency Coolant Recirculation				X			EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations.	4.2	1
E16	High Containment Radiation									
K/A Category Point Totals:		0	0	2	6	7	1	Group Point Total:		16

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PWR SRO Examination Outline  
Emergency and Abnormal Plant Evolutions - Tier 1/Group 3

ES-401-3

Number#	Name	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Pts.
028	Pressurizer Level Control Malfunction		X					AK2.03 Controllers and Positioners	2.9	1
028	Pressurizer Level Control Malfunction				X			AA2.01 PZR level indicators and alarms	3.6	1
036	Fuel Handling Incidents									
056	Loss of Off-Site Power			X				AA1.21 Reset of the ESF load sequencers	3.3*	1
E13	Steam Generator Overpressure									
E15	Containment Flooding									
K/A Category Point Totals:		0	1	0	1	1	0	Group Point Total:		3





PWR SRO Examination Outline  
Plant Systems - Tier 2/Group 2

Number#	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Pts.
002	Reactor Coolant System								X				A2.01 Loss of coolant inventory	4.4	1
006	Emergency Core Cooling System	X											K2.04 ESFAS-operated valves	3.8	1
006	Emergency Core Cooling System				X								K5.06 Operation of pumps in parallel	3.1*	1
010	Pressurizer Pressure Control System								X				A3.02 PZR pressure	3.5	1
011	Pressurizer Level Control System						X						K6.04 Operation of PZR level controllers	3.1	1
012	Reactor Protection System							X					A2.04 Erratic power supply operation	3.2	1
016	Non-Nuclear Instrumentation System			X									K3.03 SDS	3.1*	1
027	Containment Iodine Removal System														
028	Hydrogen Recombiner and Purge Control System							X					A1.02 Containment pressure	3.7*	1
029	Containment Purge System				X								K4.03 Automatic purge isolation	3.5	1
033	Spent Fuel Pool Cooling System							X					A1.01 Spent fuel pool water level	3.3	1
034	Fuel Handling Equipment System											X	2.2.30 Knowledge of RO duties in the control room during fuel handling such as alarms from fuel handling area, communication with fuel storage facility, systems operated from the control room in support of fueling operations, and supporting instrumentati	3.3	1
035	Steam Generator System														
039	Main and Reheat Steam System								X				A2.04 Malfunctioning steam dump	3.7	1
039	Main and Reheat Steam System												2.1.32 Ability to explain and apply all system limits and precautions.	3.8	1
055	Condenser Air Removal System														
062	A.C. Electrical Distribution														
064	Emergency Diesel Generators												2.2.25 Knowledge of bases in technical specifications for limiting conditions for operations and safety limits.	3.7	1
064	Emergency Diesel Generators				X								K4.11 Automatic load sequencer: safeguards	4.0	1
073	Process Radiation Monitoring System	X											K1.01 Those systems served by PRMs	3.9	1
075	Circulating Water System														
079	Station Air System														
086	Fire Protection System								X				A2.02 Low FPS header pressure	3.3	1
103	Containment System														
K/A Category Point Totals:		1	1	1	2	1	1	2	4	1	0	3	Group Point Total:		17

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PWR SRO Examination Outline  
Plant Systems - Tier 2/Group 3

ES-401-3

Number#	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Pts.										
005	Residual Heat Removal System				X								K5.05 Plant response during "solid plant" pressure change due to the relative incompressibility of water	3.1*	1										
005	Residual Heat Removal System							X					A2.02 Pressure transient protection during cold shutdown	3.7	1										
007	Pressurizer Relief Tank/Quench Tank System																								
008	Component Cooling Water System		X										K2.02 CCW pump, including emergency backup	3.2*	1										
041	Steam Dump System and Turbine Bypass Control								X				A3.02 RCS pressure, RCS temperature, and reactor power	3.4	1										
045	Main Turbine Generator System																								
076	Service Water System																								
078	Instrument Air System																								
K/A Category Point Totals:												0	1	0	0	1	0	0	1	1	0	0	0	Group Point Total:	4

Facility	Date: June 7, 1999		Exam Level:	SRO
Category	KA #	KA Topic	Imp.	Points
Conduct of Operations	2.1.1	Knowledge of conduct of operations requirements.	3.8	1
	2.1.2	Knowledge of operator responsibilities during all modes of plant operation.	4.0	1
	2.1.4	Knowledge of shift staffing requirements.	3.4	1
	2.1.13	Knowledge of facility requirements for controlling vital / controlled access.	2.9	1
	2.1.14	Knowledge of system status criteria which require the notification of plant personnel.	3.3	1
	Total			5
Equipment Control	2.2.5	Knowledge of the process for making changes in the facility as described in the safety analysis report.	2.7	1
	2.2.12	Knowledge of surveillance procedures.	3.4	1
	2.2.13	Knowledge of tagging and clearance procedures.	3.8	1
	2.2.23	Ability to track limiting conditions for operations.	3.8	1
	2.2.24	Ability to analyze the affect of maintenance activities on LCO status.	3.8	1
	Total			5
Radiation Control	2.3.1	Knowledge of 10 CFR: 20 and related facility radiation control requirements.	3.0	1
	2.3.4	Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.	3.1	1
	Total			2
Emergency Procedures and Plan	2.4.2	Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. Note: The issue of setpoints and automatic safety features is not specifically covered in the systems sections.	4.1	1
	2.4.9	Knowledge of low power / shutdown implications in accident (e.g. LOCA or loss of RHR mitigation strategies).	3.9	1
	2.4.14	Knowledge of general guidelines for EOP flowchart use.	3.9	1
	2.4.27	Knowledge of fire in the plant procedure.	3.5	1
	2.4.29	Knowledge of the emergency plan.	4.0	1
	Total			5
Tier 3 Target Point Total (RO/SRO)				17



Facility		Braidwood		Date of Exam: 06/07/99				Exam Level: RO					
Tier	Group	K/A Category Points											Point Total
		K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	
1. Emergency & Abnormal Plant Evolutions	1	3	1	4				5	2			1	16
	2	1	3	4				7	1			1	17
	3		1					1	1				3
	Tier Totals	4	5	8				13	4			2	36
2. Plant Systems	1	2	1	2	3	1	2	2	3	2	2	3	23
	2	2	2	2	2	1	1	2	2	2	2	2	20
	3		1	1		1		1	1	1	1	1	8
	Tier Totals	4	4	5	5	3	3	5	6	5	5	6	51
3. Generic Knowledge and Abilities					Cat 1		Cat 2		Cat 3		Cat 4		13
					3		3		2		5		

- Note:
- Attempt to distribute topics among all K/A Categories: select at least one topic from every K/A category within each tier.
  - Actual point totals must match those specified in the table.
  - Select topics from many systems: avoid selecting more than two or three K/A topics from a given system unless they relate to plant-specific priorities.
  - Systems/evolutions within each group are identified on the associated outline.
  - The shaded areas are not applicable to the category/tier.

Emergency and Abnormal Plant Evolutions - Tier 1/Group 1

Number#	Name	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Pts.
005	Inoperable/Stuck Control Rod			X				AK3.05 Power limits on rod misalignment	3.4	1
015	Reactor Coolant Pump Malfunctions				X			AA1.22 RCP seal failure/malfunction	4.0	1
017	Reactor Coolant Pump Malfunctions (Loss of RC Flow)									
024	Emergency Boration				X			AA1.23 CVCS centrifugal charging pump switches and indicators	3.3*	1
024	Emergency Boration			X				AK3.02 Actions contained in EOP for emergency boration	4.2	1
026	Loss of Component Cooling Water									
027	Pressurizer Pressure Control Malfunction				X			AA1.01 PZR heaters, sprays, and PORVs	4.0	1
040	Steam Line Rupture			X				AK3.04 Actions contained in EOPs for steam line rupture	4.5	1
040	Steam Line Rupture	X						AK1.06 High-energy steam line break considerations	3.7	1
051	Loss of Condenser Vacuum									
055	Station Blackout					X		EA2.03 Actions necessary to restore power	3.9	1
057	Loss of Vital AC Instrument Bus									
062	Loss of Nuclear Service Water									
067	Plant Fire on Site									
068	Control Room Evacuation				X			AA1.21 Transfer of controls from control room to shutdown panel or local control	3.9	1
068	Control Room Evacuation					X		AA2.09 Saturation margin	4.1	1
069	Loss of Containment Integrity						X	2.2.22 Knowledge of limiting conditions for operations and safety limits.	3.4	1
074	Inadequate Core Cooling				X			EA1.06 RCPS	3.6	1
074	Inadequate Core Cooling	X						EK1.03 Processes for removing decay heat from the core	4.5	1
076	High Reactor Coolant Activity									
E06	Degraded Core Cooling									
E07	Saturated Core Cooling									
E08	Pressurized Thermal Shock		X					EK2.2 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.	3.6	1
E09	Natural Circulation Operations			X				EK3.1 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.	3.3	1
E10	Natural Circulation with Steam Void in Vessel with/without RVLIS	X						EK1.2 Normal, abnormal and emergency operating procedures associated with (Natural Circulation with Steam Void in Vessel with/without RVLIS).	3.4	1
E12	Uncontrolled Depressurization of all Steam Generators									
E14	High Containment Pressure									
K/A Category Point Totals:		3	1	4	5	2	1	Group Point Total:		16

ES-401 PWR RO Examination Outline ES-401-4  
 Emergency and Abnormal Plant Evolutions - Tier 1/Group 2

Number#	Name	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Pts.
001	Continuous Rod Withdrawal									
003	Dropped Control Rod									
007	Reactor Trip				X			EA1.03 RCS pressure and temperature	4.2	1
008	Pressurizer Vapor Space Accident									
009	Small Break LOCA				X			EA1.10 Safety parameter display system	3.8*	1
011	Large Break LOCA				X			EA1.11 Long-term cooling of core	4.2	1
011	Large Break LOCA		X					EK3.12 Actions contained in EOP for emergency LOCA (large break)	4.4	1
022	Loss of Reactor Coolant Makeup				X			AA1.08 VCT level	3.4	1
025	Loss of Residual Heat Removal System			X				AK3.01 Shift to alternate flowpath	3.1	1
029	Anticipated Transient Without Scram							2.4.48 Ability to interpret control room indications to verify the status and operation of system, and understand how operator actions and directives affect plant and system conditions.	3.5	1
029	Anticipated Transient Without Scram			X				AK3.12 Actions contained in EOP for ATWS	4.4	1
032	Loss of Source Range Nuclear Instrumentation				X			AA1.01 Manual restoration of power	3.1*	1
033	Loss of Intermediate Range Nuclear Instrumentation									
037	Steam Generator Tube Leak									
038	Steam Generator Tube Rupture			X				EK3.06 Actions contained in EOP for RCS water inventory balance, S/G tube rupture, and plant shutdown procedures	4.2	1
054	Loss of Main Feedwater									
058	Loss of DC Power									
059	Accidental Liquid Radwaste Release									
060	Accidental Gaseous Radwaste Release									
061	Area Radiation Monitoring System Alarms									
E02	SI Termination				X			EA1.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.	4.0	1
E02	SI Termination		X					EK2.2 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.	3.5	1
E03	LOCA Coooldown and Depressurization				X			EA1.3 Desired operating results during abnormal and emergency situations.	3.7	1
E04	LOCA Outside Containment	X						EK1.2 Normal, abnormal and emergency operating procedures associated with (LOCA Outside Containment).	3.5	1



ES-401		PWR RO Examination Outline: Emergency and Abnormal Plant Evolutions - Tier 1/Group 2										ES-401-4
Number#	Name	K1	K2	K3	A1	A2	G	K/A Topic(s)			Imp.	Pts.
E05	Loss of Secondary Heat Sink					X		EA2.1 Facility conditions and selection of appropriate procedures during abnormal and emergency operations.			3.4	1
E05	Loss of Secondary Heat Sink		X					EK2.1 Components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features.			3.7	1
E05	Loss of Secondary Heat Sink							EK2.2 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.			3.9	1
E11	Loss of Emergency Coolant Recirculation											
E16	High Containment Radiation											
K/A Category Point Totals:		1	3	4	7	1	1	Group Point Total:				17

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PWR RO Examination Outline  
Emergency and Abnormal Plant Evolutions - Tier 1/Group 3

ES-401-4

Number#	Name	K1	K2	K3	A1	A2	G	K/A Topic(s)	Imp.	Pts.
028	Pressurizer Level Control Malfunction		X					AK2.03 Controllers and Positioners	2.6	1
028	Pressurizer Level Control Malfunction					X		AA2.01 PZR level indicators and alarms	3.4	1
036	Fuel Handling Incidents									
056	Loss of Off-Site Power						X	AA1.21 Reset of the ESF load sequencers	3.3*	1
065	Loss of Instrument Air									
E13	Steam Generator Overpressure									
E15	Containment Flooding									
K/A Category Point Totals:		0	1	0	1	1	0	Group Point Total:		3

PWR RO Examination Outline  
Plant Systems - Tier 2/Group 1

Number#	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Pts.
001	Control Rod Drive System				X								K5.05 Interpretation of rod worth curves, including proper curve to use: all rods in (ARI), all rods out (ARO), hot zero power (H2P), hot full power (HFP)	3.5	1
001	Control Rod Drive System											X	2.1.33 Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.	3.4	1
003	Reactor Coolant Pump System	X											K1.08 Containment isolation	2.7*	1
003	Reactor Coolant Pump System			X									K4.11 Isolation valve interlocks	3.0*	1
004	Chemical and Volume Control System		X										K2.03 Charging pumps	3.3	1
004	Chemical and Volume Control System					X							K6.13 Purpose and function of the boration/dilution batch controller	3.1	1
013	Engineered Safety Features Actuation System							X					A3.02 Operation of actuated equipment	4.1	1
013	Engineered Safety Features Actuation System								X				A4.03 ESFAS initiation	4.5	1
013	Engineered Safety Features Actuation System			X									K4.12 Safety injection block	3.7	1
015	Nuclear Instrumentation System		X										K3.02 CRDS	3.3*	1
015	Nuclear Instrumentation System						X						A1.04 Quadrant power tilt ratio	3.5	1
017	In-Core Temperature Monitor System						X						A1.01 Core exit temperature	3.7	1
022	Containment Cooling System											X	2.1.32 Ability to explain and apply all system limits and precautions.	3.4	1
022	Containment Cooling System		X										K3.01 Containment equipment subject to damage by high or low temperature, humidity, and pressure	2.9*	1
025	Ice Condenser System												A2.04 Loss of condensate pumps	2.6	1
056	Condensate System							X					A3.07 ICS	3.4*	1
059	Main Feedwater System								X				K1.04 S/GS water level control system	3.4	1
059	Main Feedwater System	X													
061	Auxiliary / Emergency Feedwater System						X						K6.02 Pumps	2.6	1
061	Auxiliary / Emergency Feedwater System											X	2.1.33 Ability to recognize indications for system operating parameters which are entry-level conditions for technical specifications.	3.4	1
061	Auxiliary / Emergency Feedwater System							X					A2.04 pump failure or improper operation	3.4	1



ES-401		PWR RO Examination Outline											ES-401-4		
		Plant Systems - Tier 2/Group 1													
Number#	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	G	K/A Topic(s)	Imp.	Pts.
068	Liquid Radwaste System				X								K4.01 Safety and environmental precautions for handling hot, acidic, and radioactive liquids	3.4	1
071	Waste Gas Disposal System										X		A4.05 Gas decay tanks, including valves, indicators, and sample line	2.6*	1
072	Area Radiation Monitoring System							X					A2.02 Detector failure	2.8	1
K/A Category Point Totals:		2	1	2	3	1	2	2	3	2	2	3	Group Point Total:		23

PWR RO Examination Outline  
Plant Systems - Tier 2/Group 2

Number#	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	A4	G	K/A Topic(s)	Imp.	Pts.
002	Reactor Coolant System	X												K1.04 RCS vent system	2.8	1
006	Emergency Core Cooling System				X									K5.08 Operation of pumps in parallel	2.9*	1
006	Emergency Core Cooling System	X												K2.04 ESFAS-operated valves	3.6	1
010	Pressurizer Pressure Control System								X					A3.02 PZR pressure	3.6	1
011	Pressurizer Level Control System					X								K6.04 Operation of PZR level controllers	3.1	1
012	Reactor Protection System												X	2.1.28 Knowledge of the purpose and function of major system components and controls.	3.2	1
012	Reactor Protection System							X						A2.04 Erratic power supply operation	3.1	1
014	Rod Position Indication System						X							A1.02 Control rod position indication on control room panels	3.2	1
016	Non-Nuclear Instrumentation System		X											K3.03 SDS	3.0*	1
026	Containment Spray System		X											K3.02 Recirculation spray system	4.2*	1
026	Containment Spray System									X				A4.01 CSS controls	4.5	1
029	Containment Purge System				X									K4.03 Automatic purge isolation	3.2	1
033	Spent Fuel Pool Cooling System						X							A1.01 Spent fuel pool water level	2.7	1
035	Steam Generator System															
039	Main and Reheat Steam System												X	2.1.32 Ability to explain and apply all system limits and precautions.	3.4	1
055	Condenser Air Removal System															
062	A.C. Electrical Distribution	X												K2.01 Major system loads	3.3	1
063	D.C. Electrical Distribution								X					A3.01 Meters, annunciators, dials, recorders, and indicating lights	2.7	1
064	Emergency Diesel Generators													A4.02 Adjustment of exciter voltage (using voltage control switch)	3.3	1
064	Emergency Diesel Generators				X					X				K4.11 Automatic load sequencer: safeguards	3.5	1
073	Process Radiation Monitoring System	X												K1.01 Those systems served by PRMs	3.6	1
075	Circulating Water System															
079	Station Air System															
086	Fire Protection System							X						A2.02 Low FPS header pressure	3.0	1
K/A Category Point Totals:		2	2	2	2	1	1	2	2	2	2	2	2	Group Point Total:		20



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PWR RO Examination Outline  
Plant Systems - Tier 2/Group 3

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Number#	Name	K1	K2	K3	K4	K5	K6	A1	A2	A3	A4	A G	K/A Topic(s)	Imp.	Pts.
005	Residual Heat Removal System				X								K5.05 Plant response during "solid plant" pressure change due to the relative incompressibility of water	2.7*	1
005	Residual Heat Removal System							X					A2.04 RHR valve malfunction	2.9	1
007	Pressurizer Relief Tank/Quench Tank System														
008	Component Cooling Water System		X										K2.02 CCW pump, including emergency backup	3.0*	1
027	Containment Iodine Removal System														
028	Hydrogen Recombiner and Purge Control System							X					A1.02 Containment pressure	3.4*	1
034	Fuel Handling Equipment System														
041	Steam Dump System and Turbine Bypass Control								X				A3.02 RCS pressure, RCS temperature, and reactor power	3.3	1
045	Main Turbine Generator System												2.1.25 Ability to obtain and interpret station reference materials such as graphs, monographs, and tables which contain performance data.	2.8	1
076	Service Water System										X		A4.01 SWS pumps	2.9	1
078	Instrument Air System												K3.02 Systems having pneumatic valves and controls	3.4	1
103	Containment System														
K/A Category Point Totals:		0	1	1	0	1	0	1	1	1	1	1	Group Point Total:		8



Facility	Date: June 7, 1999		Exam Level:	RO
Category	KA #	KA Topic	Imp.	Points
Conduct of Operations	2.1.1	Knowledge of conduct of operations requirements.	3.7	1
	2.1.14	Knowledge of system status criteria which require the notification of plant personnel.	2.5	1
	2.1.2	Knowledge of operator responsibilities during all modes of plant operation.	3.0	1
Total				3
Equipment Control	2.2.12	Knowledge of surveillance procedures.	3.0	1
	2.2.13	Knowledge of tagging and clearance procedures.	3.6	1
	2.2.23	Ability to track limiting conditions for operations.	2.6	1
Total				3
Radiation Control	2.3.1	Knowledge of 10 CFR: 20 and related facility radiation control requirements.	2.6	1
	2.3.4	Knowledge of radiation exposure limits and contamination control, including permissible levels in excess of those authorized.	2.5	1
Total				2
Emergency Procedures and Plan	2.4.2	Knowledge of system set points, interlocks and automatic actions associated with EOP entry conditions. Note: The issue of setpoints and automatic safety features is not specifically covered in the systems sections.	3.9	1
	2.4.9	Knowledge of low power / shutdown implications in accident (e.g. LOCA or loss of RHR mitigation strategies).	3.3	1
	2.4.14	Knowledge of general guidelines for EOP flowchart use.	3.0	1
	2.4.27	Knowledge of fire in the plant procedure.	3.0	1
	2.4.32	Knowledge of operator response to loss of all annunciators.	3.3	1
Total				5
Tier 3 Target Point Total (RO/SRO)				13

INITIAL SUBMITTAL OF THE BRAIDWOOD INITIAL EXAMINATION

THE WEEK OF JUNE 7, 1999

A070