U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No. 50-305 License No. DPR-43

Licensee: Wisconsin Public Service Corporation
Post Office Box 1200
Green Bay, Wisconsin 54305

Facility Name: Kewaunee Nuclear Power Plant

Examinations At: Kewaunee Nuclear Power Plant

Examinations Conducted: April 17 and 18, 1984

Examiners: T Reidinger — 5/25/84
T. Reidinger — Date

J D McMillen for — 5/29/84
B. Picker — Date

R. Higgins — 5/29/84
R. Higgins — Date

Approved By: J. I. McMillen — 5/29/84
J. I. McMillen, Chief — Date
Operator Licensing Section

Examination Summary

Examinations on April 17 and 18, 1984
The applicants consisted of 2 RO and 1 SRO candidates.
Results: All candidates passed.

REPORT DETAILS

1. Examiners

*T. D. Reidinger
B. A. Picker
R. Higgins

*Chief Examiner

2. Examination Review Meeting

The exam review was conducted by the examiners and facility representatives as follows.

RO/SRO

*F. Stanaszak
R. Zube
J. Brown
D. Braun

*Facility Training Manager

The facility comments and resolution of those comments are as follows:

Question	Comment/Resolution
1.06.a.2	The facility pointed out that the question may also elicit Doppler Temperature Coefficient explanation. The examiner did not accept the comment. No change was needed to elicit a correct response to the question.
1.06.b	The facility provided references for Cycle 9 in the Reactor Data Book. The answer key was changed to reflect the new data.
1.07.a & b	The facility indicated that parts "a" and "b" appear to be a double jeopardy question. (If the candidate committed an error on "a" then it is possible this could result in an error on "b".) The examiner did not accept the comment. Part "a" looks at the loop flow changes due to head loss changes, while part "b" looks at back flow through the idle loop and its effect on core flow.
1.09	The facility stated that the "withdrawal limit" and "maneuvering band" terms are not emphasized in this manner during training. The facility pointed out that the most probable answer from the candidates would include automatic rod withdrawal precautions on dropped rods or rod misalignment limitations. The examiner did not accept the comment. The question was written from those areas described in the referenced material provided by the facility as being part of the operator training.

Question	Comment/Resolution
2.02.a	The facility provided references that changed coincidences to 3/3 detectors from 1/2 and changed the pressure setpoint to 23 psig from 17 psig. The examiner corrected the answer key to reflect the new data.
2.03.a	The facility pointed out that the reactor trip will not completely isolate feedwater. The trip will only trip Main Feedwater Valves and not the Main Feedwater Bypass Valves. The examiner amended the answer key to delete Main Feedwater Bypass Valves. Points were redistributed.
2.05.e.1	The facility pointed out that there is no isolation valve on component cooling to letdown heat exchanger. The examiner amended the answer key to read: "No, there is no isolation valve on CCW system side of letdown heat exchanger."
2.05.c.2	The facility provided references that showed there are no safety injection actuated valves in the component cooling system. The examiner deleted the phrase "until a phase B signal is actuated."
3.04	The facility requested that part "5" of answer key be deleted as this is a secondary trip input per the trip logic diagram vice a "direct" trip as the rest of the answers indicate. The examiner clarified the key to reflect that, if given, this answer will not be counted incorrect because the question asked for six (6) responses and with this deletion there are only five (5) possible. Amended the question to ask for "five (5) reactor trips..."
3.06.b	The facility provided references that indicated that OPΔT would not be a protection signal in this casualty. The examiner deleted OPΔT.
3.07	The facility stated that steam dumps will not arm on failure of PM-485 because the arming signal comes from PM-486. The examiner amended the answer key.
3.07.a.3	The facility provided references to show that pressurizer level would increase to 50% not 100% of span. The examiner amended the answer key.
4.05.c	The facility stated that facility procedures do not cover this occurrence and therefore it is not a valid question for the candidates. The examiner asked the facility if the candidate could use a logical approach to minimize this accident. The facility stated it is not covered in the training program. The examiner deleted this part of the question. The examiner requested the facility to address this problem in training prior to the next licensing examination. The facility agreed.

Question	Comment/Resolution
4.06.a.3	The facility provided a reference to show that AFW flow is not a direct criteria. The examiner deleted AFW flow.
4.07.c.1	The facility indicated that it is desirable to energize the heaters in the condition stated vice turning heaters off. The examiner deleted the "heaters off" portion of the answer key.
4.08.b.2	The facility stated there could be confusion about using valve numbers and valve descriptions. The candidates do not really memorize valve numbers, but should know valve descriptions. RHR-10 is a typographical error and as such there could be 2 different answers. RHR-10 would be closed and RHR Heat Exchanger Bypass Valve RHR-101 would be throttled. The examiner will accept either answer.
5.06.a.2	The facility pointed out that the question may also elicit Doppler Temperature Coefficient explanation. The examiner did not accept the comment. No change was needed to elicit a correct response to the question.
5.06.b	The facility provided references for cycle 9 in the Reactor Data Book. The answer key was changed to reflect the new data.
5.07.a & b	The facility indicated that parts "a" and "b" appear to be a double jeopardy question. (If the candidate makes an error on "a" then he will probably make an error on "b".) The examiner did not accept the comment. Part "a" looks at the loop flow changes due to head loss changes, while part "b" looks at back flow through the idle loop and its effect on core flow.
5.09	The facility stated that the "withdrawal limit" and "maneuvering band" terms are not emphasized in this manner during training. The facility pointed out that the most probable answer from the candidates would include automatic rod withdrawal precautions on dropped rods or rod misalignment limitations. The examiner did not accept the comment. The question was written from those areas described in the referenced material provided by the facility as being part of the operator training.
6.03 c	The facility questioned that the answer should not require 700 psig auto close as an interlock since this is a protective function in their opinion. The examiner did not accept the comment. Facility systems description P34 on page 5 describes this 700 psig setpoint as an interlock.

Question	Comment/Resolution
6.07.a	The facility stated that the answer is hard to follow and they are unsure of sequence of events. The facility provided a training handout of what it surmised was the correct answer. The examiner did not accept this comment. The training handout does not cover the sequence of events requested in the answer.
7.01.b.3	The facility provided references to indicate the time required for a Special RWP. The examiner accepted the definition.
7.07.a	The facility provided new data, dated April 10, 1984, requesting that the temperature be changed to 350°F from 250°F. This would be in compliance with the technical specifications. The examiner accepted the new data.

4. Exit Meeting

Facility representatives from Material Training, Simulator Training, Operations and Plant Management, the NRC Resident Inspector, and the examiners met on April 18, 1984, to summarize the results of the oral examinations. The examiners indicated those that clearly passed. No generic weaknesses noted.

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

Reviewed by
F. Stanazak
R. Iube
J. Brown
D. Braun

FACILITY: KEWAUNEE

REACTOR TYPE: PWR

DATE ADMINISTERED: 84/09/12

EXAMINER: PICKER, B.

APPLICANT: MASTER COPY

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE		CATEGORY
25.00	25.00			1.	PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
25.00	25.00			2.	PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
25.00	25.00			3.	INSTRUMENTS AND CONTROLS
~~25.00~~ 23.8	25.00			4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
~~100.00~~ 98.8	100.00				TOTALS

FINAL GRADE _____%

All work done on this examination is my own. I have neither given nor received aid.

_____
APPLICANT'S SIGNATURE

QUESTION 1.01 (2.50)

Indicate how the following will affect UNIT efficiency at steady state power level. (Consider the affected parameter only and indicate increase, decrease, or no change.)

a. Absolute condenser pressure changes from 1 psi to 1.25 psi.

b. Total S/G blowdown is changed from 35 to 40 gpm.

c. Condenser hotwell temperature changes from 125 F to 130 F.

d. Steam quality changes from 99.8% to 99.7%.

e. Current being drawn by Reactor Coolant Pumps increases slightly due to a slight change in bus voltage. (2.5)

QUESTION 1.02 (3.00)

a. Why is the primary system flowrate approximately 10 times greater than secondary system flowrate? (1.5)

b. Why is a primary heat balance considered less accurate than a secondary heat balance? (1.5)

QUESTION 1.03 (4.00)

a. Compare Xenon-135 and Samarium-149 fission product poisons by EXPLAINING the differences for the following: (actual values are not necessary)

1. Time to reach equilibrium conditions after startup. (1.0)
2. Magnitude of negative reactivity at equilibrium conditions. (1.5)

b. Explain why the following statement IS or IS NOT true. "Equilibrium Xenon concentration at 50% power is NOT approximately half its concentration at 100% power". (1.5)

QUESTION 1.04 (3.00)

A reactor has the following characteristics:

1. Power defect = 1000 pcm
2. Total Rod Worth = 7000 pcm
3. Shutdown Rod Worth = 2000 pcm
4. Equilibrium Xenon = 2800 pcm
5. Peak Xenon = 5200 pcm

The reactor has been operating at steady-state for three weeks when a trip from 100% power occurs and the shutdown rods are pulled two hours later. Assume no boration by the operator.

a. What is the shutdown margin (SDM) immediately following the trip? (1.0)

b. What is the SDM eight hours after the trip? (1.0)

c. What is the SDM three days after the trip? (1.0)

QUESTION 1.05 (1.20)

When a pressurizer PORV is used to depressurize the RCS (during a S/G tube rupture recovery) you should expect to see pressurizer level (INCREASE, DECREASE, or REMAIN THE SAME). WHY? (1.2)

QUESTION 1.06 (2.80)

a. For each of the coefficients below: How do they vary over core age and Why?

   1. Moderator Temperature Coefficient. (1.0)
   2. Doppler Coefficient. (1.0)

b. What are the approximate values in PCM for each coefficient in (a) above over core life (BOL to EOL 100% pwr.)? (0.8)

QUESTION 1.07 (3.00)

Assume one RCP trips at 30% power, without a reactor protection system actuation or a change in turbine load. Indicate whether the following parameters will INCREASE, DECREASE, or REMAIN THE SAME.

a. Flow in the operating reactor coolant loops. (0.6)

b. The ratio of core flow compared to the total loop flow. (Core Flow/Total Loop Flow) (0.6)

c. Reactor Vessel delta P. (0.6)

d. Core delta T. (0.6)

e. Operating loop steam generator temperature. (0.6)

QUESTION 1.08 (2.50)

The reactor is operating at 100% power and no steam generator tubes are plugged. Steam generator pressure is 770 psig and RCS Tave is 574 F. If 25% of the S/G tubes are plugged, how much change must take place in Tave of the RCS in order to maintain the S/G pressure at 770 psig, when the reactor power is at 100%? Show all Work. Use the Steam Tables. (2.5)

QUESTION 1.09 (3.00)

Core operating limits and procedures are closely related to full length rod positioning parameters thus establishing Rod Operational Limits. Name the THREE positioning parameters and BRIEFLY explain the purpose of each. (3.0)

QUESTION 2.01 (3.00)

a. Provide FOUR seperate conditions that could result in a failure of the Emergency Diesel Generator to start in the automatic mode. (2.0)

b. Describe the sequence of events that must take place in order for the Diesel Generator Fire Protection System to automatically actuate. (1.0)

QUESTION 2.02 (3.50)

a. What conditions automatically initiate Containment Spray? Include setpoints and logic/coincidence where applicable. (1.5)

b. What sequence of events occurrs to start spray when a Containment Spray Actuation Signal is initiated? (2.0)

QUESTION 2.03 (3.00)

a. What conditions cause complete feedwater isolation? Include applicable COINCIDENCE and SETPOINTS. (1.4)

b. In addition to complete isolation of feedwater, what does a feedwater isolation signal directly accomplish? (1.0)

c. If operating at 95% power and one Main Feed Pump trips, what automatic action occurs? (0.6)

QUESTION 2.04 (3.00)

a. What protection is provided that will automatically TRIP the Turbine-Driven and Motor-Driven Auxiliary Feedwater Pumps to prevent their damage? (2.0)

b. In addition to providing minimum pump flow, what does the AFWP recirculation flow accomplish for each pump? (1.0)

QUESTION 2.05 (3.50)

The Reactor is operating in Mode 1 with all associated support systems in normal when a RCS leak to CCW occurs in the Letdown Heat Exchanger and R-17 alarms.

a. What automatic action(s) occur? (0.5)

b. The CCW side of the Letdown Hx ruptures resulting in a loss of CCW and a LOCA.

1. How is the CCW surge tank protected during this outsurge? (0.5)

2. If CCW system pressure has dropped to 25 psig, will the standby CCW pump start? Explain. (0.9)

c. The LOCA resulted in a Safety Injection and Containment Isolation Phase A.

1. Is the CCW leak isolated at this time? Explain. (0.8)

2. Is CCW flow still available to the RCP's? Explain. (0.8)

QUESTION 2.06 (2.50)

The relief valves listed below protect the charging and letdown portions of the Chemical and Volume Control System. Match the relief valve with its respective tank and setpoint.

VALVE	LOCATION	SETPOINT	RELIEVES TO
LD-5	letdown line downstream of letdown orifices	a. 200 psig	1. Reactor Coolant Drain Tank
LD-13	letdown line downstream of low pressure letdown valve	b. 75 psig	2. Volume Control Tank
CVC-40	Volume Control Tank	c. 2735 psig	3. Pressurizer Relief Tank
CVC-101A	Reciprocating charging pump discharge	d. 150 psig	4. Waste Gas Tank
CVC-261	RCP sealwater return line	e. 600 psig	5. Holdup Tank (2.5)

QUESTION 2.07 (3.50)

a. What are the preferred and alternate power supply paths from 480V to Instrument Bus I. (2.0)

b. What electrical system changes are required if Battery Charger BRA-108 must be removed from service for...

1. a short time (i.e. routine maintenance, etc.). (0.75)

2. an extended period of time due to Charger failure. (0.75)

QUESTION 2.08 (3.00)

There are FOUR sets of valve interlocks associated with the Safety Injection Systems. NAME and DESCRIBE 3 of the interlocks and the PURPOSE of each. (3.0)

QUESTION 3.01 (3.00)

a. List the logic networks which receive a signal from the turbine trip logic network. (1.0)

b. Describe the sequence of events (Turbine oil system interactions) which must take place to result in a turbine trip from the time that the turbine manual trip ~~switch~~ pushbutton is ~~pushed turned~~ in the control room until the turbine's power output is zero. (2.0)

QUESTION 3.02 (3.00)

The unit has been operating at 45% power with all systems in automatic. For each of the following conditions, give the direction of rod motion and explain why there is rod motion:

a. The steam generator power operated relief valve fails open. (1.0)

b. A feedwater heater string becomes isolated. (1.0)

c. The lower detector of the power range channel N44 fails high. (1.0)

QUESTION 3.03 (3.00)

a. Briefly explain the operation of the Low Pressurizer Pressure SI block function. Include any logic required. (1.0)

b. What are the other TWO permissives (by number) that allow manual blocking of Safeguards Protection? (1.0)

c. What are the TWO permissives (by number) that automatically block Safeguards Protection? (1.0)

QUESTION 3.04 (3.00)

Which ~~SIX~~ Five reactor trips protect against DNB violations? Include coincidence logic. (3.0)

QUESTION 3.05 (4.00)

a. If a turbine trip occurred from 100% power what would be the difference between Tave and Tref if:

1. SIX steam dump valves were to be TRIPPED open? (0.75)

2. TWELVE steam dump valves were to be TRIPPED open? (0.75)

b. Which steam dump controller will control the steam dumps on a turbine trip from an inital power of LESS THAN 50%? (0.75)

c. On a sudden loss of load and NO turbine turbine trip from an initial power GREATER THAN 50% which steam dump controller will control the steam dump. (0.75)

d. In addition to being an input to the steam dump controllers, what function does the Tave signal accomplish in the Steam Dump Control System? (1.0)

QUESTION 3.06 (2.50)

Your Protection System is designed so that a turbine trip will cause a Reactor Trip above 10% power:

a. Why is the system designed to do this? (1.0)

b. What protection signal(s) will provide Rx protection in the event that the Turbine Trip/Reactor Trip Protection does not function on a turbine trip from full power?
NO SETPOINTS REQUIRED! (1.0)

c. How does the Reactor Protection System sense that a turbine trip has occurred? (0.5)

QUESTION 3.07 (3.50)

Assume the plant is at 75% power, with automatic rod control and the following instruments are selected for control, when they fail simultaniously.

- PM-485A Turbine 1st stage pressure instrument fails LOW
- Loop B Cold leg temperature fails HIGH

a. Describe how the following systems will react AND briefly explain WHY.

1. Control Rods.
2. Steam Dumps.
3. Pressurizer Level Control. (2.5)

b. What protective signal(s), if any, would trip the plant if no operator action was taken. Briefly EXPLAIN. (1.0)

QUESTION 3.08 (3.00)

a. A break in the reference leg in the pressurizer level indicator will cause the indicated level to be higher than the actual level. TRUE or FALSE? (0.5)

b. What would a low temperature alarm on TE-421 (surge line) indicate? Assume that the plant is at steady state and the instrument has not failed. (1.0)

c. List the location(s) that has/have indication for LT-433 Pressurizer Level -(cold calibrated). (1.5)

QUESTION 4.01 (3.00)

Normally the RCP #1 Seal Bypass line shall remain closed unless either of two alarms are approached. The bypass line should then be opened if FOUR conditions are satisfied.

a. What are the TWO alarm conditions that would require opening the bypass? (1.0)

b. What are the FOUR conditions that must be met prior to opening the bypass valve? (2.0)

QUESTION 4.02 (2.20)

Provide the Federal and Plant Administrative quarterly radiation exposure limits for the following:

a. Whole body (include extension limits) (0.75)

b. Skin of the Whole body (0.5)

c. Hands, forearms, feet and ankles. (0.5)

d. When is an individual's dose said to be meeting the ALARA concept? (0.45)

QUESTION 4.03 (3.50)

Answer the following questions about "Natural Circulation Operation", procedure N-0-06.

a. Provide the TWO methods of determing effective natural circulation. (1.0)

b. What is the maximum cooldown rate allowed? (0.5)

c. What action are you required to take if one control rod indicates not fully inserted? (1.0)

d. While performing a cooldown in natural circulation, why are the RCS subcooling requirements much more restrictive if the Control Rod Drive Mechanism cooling units are not in operation? (1.0)

QUESTION 4.04 (2.50)

Assume that it is 0300 Hrs. on 6/19/84 and the facility is presently at 45% power. Considering the Delta-I penalty history below, are you now allowed to increase power above 50% power? If not, when may power be increased? EXPLAIN.

DATE	TIME(out)	TIME(in)	POWER	
6/18/84	0300	0318	85%	
6/18/84	1557	1633	65%	
6/19/84	0138	0300	45%	(2.5)

QUESTION 4.05 (4.00)

a. List FOUR indications that may be used to identify a faulted Steam Generator with a tube leak/rupture. (1.2)

b. How is a faulted Steam Generator isolated? (1.6)

c. If the MSIV on a faulted S/G cannot be fully closed, how is the radio-active release minimized while cooling down the Reactor Coolant System? (1.2)

QUESTION 4.06 (2.80)

Assume that a Loss of Coolant Accident has occured at the Kewaunee Power Station.

a. What are the Safety Injection termination criteria? (1.6)

b. Under what conditions must Safety Injection be MANUALLY reinitiated? (1.2)

QUESTION 4.07 (4.00)

a. List FIVE of the seven immediate symptoms of the controlling pressurizer pressure channel failing high, while at power. (1.5)

b. What automatic control actions will occur as a result of this failure? (1.0)

c. What 3 manual actions are required? (1.5)

QUESTION 4.08 (3.00)

a. What RCS pressure and temperature limits are imposed when the Residual Heat Removal (RHR) system is placed in service? (1.0)

b. The RHR system is in the normal cooldown mode through RHR-11 (RHR to loop B Accumulator line) utilizing both RHR pumps and letting down to the CVCS for solid plant pressure control. Provide the valve condition/position (OPEN, SHUT, MANUALLY THROTTLED, or AUTOMATIC) for the following valves.

1. RHR-8B (RHR flow regulating valve).
2. RHR-10 (RHR Heat Exchanger bypass valve).
3. SI-300B (RHR suction from RWST).
4. LD-60 (Low pressure letdown valve-CVCS)
5. CC-403B (RHR Heat Exchanger return valve-CVCS) (2.0)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 1.01 (2.50)

a. Decrease
b. Decrease
c. Increase
d. Decrease
e. No change [0.5 each] (2.5)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR II
Chapter 12, PP. 21-26

ANSWER 1.02 (3.00)

a. Due to the CHANGE IN PHASE on the secondary side of the steam generator, its enthalpy rise is roughly ten times the primary side enthalpy drop. Since the ENERGY GAINED by the feedwater MUST be EQUAL to THE ENERGY RELEASED from the primary system,

(m dh) primary = (m dh) secondary

the primary mass flow rate must be approximately ten times the secondary system flow rate. (1.5)

b. Due to the large secondary enthalpy change [0.75], the percent error from temperature, pressure, and flow sensitivity is smaller [0.5]. Also, primary system flow instruments are very inaccurate [0.25]. (1.5)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR I
Chapter 1, PP. 19-22

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 1.03 (4.00)

a. 1. Samarium takes much longer to reach equilibrium conditions [0.5] because it is formed by decay of a precursor with a longer half life than for Xenon [0.5]. (1.0)

2. Xenon has the most worth at equilibrium [0.5] because it is more abundant [0.5] and because it has a higher neutron absorbtion cross-section [0.5] (1.5)

b. True [0.5], Equilibrium Xenon is flux dependent and non-linear [0.5] since burnout is relatively less significant at 50% power than at 100% power (production is flux dependent but removal terms are not both flux dependent) [0.5] (1.5)

REFERENCE
Kewaunee Nuclear Plant Training Manual (WNTO-7606) I-6.39-46

ANSWER 1.04 (3.00)

a. Initial Rect = 0.000
Rods = -.070
Power Defect = +.010

0.06 delta-K or 6000 pcm shutdown (1.0)

b. -0.060
S.D. Rods = +0.020 (optional - may not include due to T.S. def. of SDM)
Xenon = -0.02~~84~~

0.06~~84~~ delta-K or 6400 pcm shutdown (1.0)

c. -0.06~~84~~
Xenon = +0.052

0.01~~2~~ delta-K or 1200 pcm shutdown (1.0)

No penalty if 1 rod is considered stuck or if S.D. rod worth not Considered if done consistantly due to T.S. definition of SDM

REFERENCE
Reactor Theory Manual, Chapter 9

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 1.05 (1.20)

An increase is expected as liquid replaces the escaping steam.
(Also accept an explanation of swell phenomenon) (1.2)

REFERENCE
KNP Training Manual (WNTO-7803) II-1.4

ANSWER 1.06 (2.80)

a. 1. MTC becomes more negative [0.5] -- because as boron is reduced over core life (due to fuel depletion) the positive effect of 1 F change in boron concentration is reduced (as temp. increases, density decreases thus more boron is removed from the core) [0.5],

OR

neutron leakage is increased due to the radial flux shift outward at EOL [0.5]. (1.0)

2. DOPPLER COEFFICIENT -- gets less negative [0.5] due to the decrease in fuel to clad gap [0.3] (clad creep) because of increased heat transfer and reducing the effect of fuel temperature [0.2]. (1.0)

b.

	BOL [0.2 each]	EOL [0.2 each]	
MTC	~~-1~~ 16.4 (+/-) 2 PCM/ F	~~-31~~ 27 (+/-) 2 PCM/ F	corrected for cycle 9 full load
Doppler	-~~12~~ 13.5 (+/-) 2 PCM/%	-11 (+/-) 2 PCM/%	

(0.8)

REFERENCE
KNP Training Manual, I-6.2-18

ANSWER 1.07 (3.00)

a. Increase
b. Decrease
c. Decrease
d. Increase
e. Decrease [0.6 each] (3.0)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR II
Chapter 12, pp. 15-16

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 1.08 (2.50)

Steam Generator Heat Transfer: Q=UA delta T [0.5]
where delta T = Tave - Tsat (sec)

Q, U, and Tsat (sec) remain constant, therefore,

Q/A = A1[Tave 1 - Tsat (sec)] = A2[Tave 2 - Tsat (sec)] [0.5]

From given info. A2=0.75 A1

From Steam Tables: Tsat (sec) = 512-516 F [0.7]

A1 (574 - 514) = 0.75 A1 (Tave 2 - 514) Tave 2 = 594 F

Therefore: Tave must increase by 19-21 F [0.8] (2.5)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR I
Chapter 6

ANSWER 1.09 (3.00)

a. WITHDRAWAL LIMIT [0.5] - Imposed to help avoid dumping steam if a decrease in power is initiated. [0.5] (1.0)

b. MANEUVERING BAND [0.5] - To allow an immediate return to full power at anytime from a lower power [0.25] as well as to help maintain a fairly even axial fuel depletion [0.25] (1.0)

c. INSERTION LIMITS [0.5] - Assures the ability to shutdown at any-time, under any conditions [0.5] (1.0)

REFERENCE
KNP Training Manual (WNTD-7606) I-6.30

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 2.01 (3.00)

a. -Start failure
-Engine overspeed
-Lo lube oil pressure
-Lo Jacket water pressure
[0.5 each] (2.0)

b. Fire detectors actuate [0.5], master valve admits a timed CO2 discharge [0.5] (1.0)

REFERENCE
KNP System Descriptions, 8, p. 8

ANSWER 2.02 (3.50)

a. - Hi Hi Containment Pressure [0.5], ~~2/3~~ 1/2 to 3/3 sets of sensors [0.25], 23 psig [0.25]
~~Manual [0.25], 1/2 [0.25]~~ 2/2 question does not elicit manual action (1.5)

b. 1. Start of Spray Pumps.
2. Openins of both discharge valves.
3. Closure of control valves in Test line to RWST.
4. Openins of the two Caustic addition control valves. (2.0)

REFERENCE
KNP Trainins Manual IV-11 & 12

ANSWER 2.03 (3.00)

a. 1. Hi Hi S/G level [0.4], 2/3, 67% [0.2]
2. Safety injection actuation [0.4], any
~~3. Reactor trip [0.4], (any) with 2/4 Low Tave 540 F [0.1]~~ (1.4)

b. Trip both MFP's and Turbine trip. (1.0)

c. Load runback on Main Turbine. (0.6)

REFERENCE
KNP System Descriptions 5A, p. 17
KNP Trainins Manual IV-12.22,23

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 2.04 (3.00)

	TD	MD		
a.				
1.	Overspeed	1. Overcurrent		
2.	Lo lube oil pressure	2. Lo lube oil pressure	[0.5 each]	(2.0)
b.	TD	MD		
1.	Pump lube oil coolers	1. Pump lube oil cooler		
2.	Turbine drive bearing coolers		[0.33 each]	(1.0)

REFERENCE
KNP System Descriptions 5B, p. 6
KNP Annunciator Response 47009-14, 47010-44

ANSWER 2.05 (3.50)

a. Surge tank vent shuts (CC-104) (0.5)

b. 1. Surge tank Vacuum Breaker opens. (0.5)

2. Yes [0.45] at (35 psig) operating pump low header pressure [0.45] (providing the standby pump control was in AUTO) (0.9)

c. 1. No [0.4] ~~Letdown Hx Isolation valve CRV-470 shuts, but it is located on the Hx discharge piping~~ No isolation valve [0.4]. (0.8)

2. Yes [0.4] CCW to RCP's is not isolated ~~until a Phase B signal is actuated~~. [0.4] (0.8)

REFERENCE
KNP System Descriptions 45, p. 6
Flow Diagrams XK100-19, 35

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 2.06 (2.50)

LD-5	e,3		
LD-15	a,2		
CVC-40	b,5		
CVC101a	c,2		
CVC-261	d,3	[0.25 each response]	(2.5)

REFERENCE
KNP Flow Diagrams XK100-35, 36

ANSWER 2.07 (3.50)

a. Perferred: 480 V MCC-1-52C to AC inverter (BRA-111) to Instrument bus I (1.0)
Alternate: 480 V MCC-1-52C (normal) or MCC-1-52E (alt) via an Auto transfer switch to 120 V cabinet BRA-105 to Instrument Bus I. (1.0)

b. 1. Transfer DC loads to opposite DC Bus. (0.75)

2. Disconnect failed charger and move spare charger into position and connect to circuits to carry loads. (0.75)

REFERENCE
KNP System Descriptions 38, pp. 20, 21
KNP Electric ' Distribution Drawing E233P

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 2.08 (3.00)

(3 of 4 required)

1. Interlock between Containment Sump and Test Line Valves: (0.2)
   Requirement: Test line valves must be closed to open the sump isolation valves. (0.4)
   Purpose: Prevents inadvertent release of containment vapor to the RWST. (0.4)

2. Accumulator Isolation Valves Interlock: (0.2)
   Requirement: Stem mounted limit switch trips an annunciator in the control room if either valve is shut and RCS pressure is > SI unblock pressure. (0.4)
   Purpose: To alert the operator that the Accumulators are isolated. (0.4)

3. SI Pump Recirculation Valve Interlock: (0.2)
   Requirement: Interlocked with RHR pump discharge pressure instrument to prevent opening of RHR-300 A/B (0.4)
   Purpose: Prevents overpressuring SI pump suction piping. (0.4)

4. SI Pump Suction Valve Interlock: (0.2)
   Requirements: RHR-300 A or B cannot be opened unless SI pump suctions are shut. (0.4)
   Purpose: Prevent pumping contaminated sump water into the RWST with the RHR pumps. (0.4)

REFERENCE
KNP System Description 33, pp 8, 9

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 3.01 (3.00)

a. Reactor trip
Steam dump control
Generator trip
Aux bus transfer
Diesel generator auto start (1.0)

b. 1. Manual trip causes the Auto Stop Oil pressure to dump. (0.4)
2. Auto Stop Oil causes Emergency Trip Fluid dump. (0.4)
3. Emergency Trip dump closes - Stop valves, Reheat valves and dumps Control Emergency Trip Fluid. (0.4)
4. Control Emergency Trip Fluid closes - Intercept and Control valves. (0.4)
5. When the Stop valves are closed a signal is processed to trip the generator after a 30 sec. time delay. (0.4)

REFERENCE
KNP Training Manual IV-12.30, 31

ANSWER 3.02 (3.00)

a. Steam flow increases causing increased removal of heat from the RCS; Tave decreases. Reactor control system moves the rods OUT because of the Tref-Tave deviation. (1.0)

b. This causes decreased efficiency in the secondary plant cycle for the same turbine load output; Tave will decrease because of greater heat removal. The Tref-Tave deviation causes a rod withdrawal. (1.0)

c. This is input to the rod control system and will cause the rods to insert attempting to reduce reactor power. (1.0)

REFERENCE
KNP System Description 5
KNP Training Manual IV-1,3

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 3.03 (3.00)

a. A manual block that is allowed when 2/3 PZR pressure channels are < 2000# [0.5]. The block will be cleared if 2/3 PZR pressure channels indicate > 2000# [0.5]. (1.0)

b. P-6, P-10 (1.0)

c. P-7, P-8 (1.0)

REFERENCE
KNP Training Manual IV-11.14
KNP Logic Diagram XK100-143-150

ANSWER 3.04 (3.00)

1.	PZR low pressure:	2/4 [0.5]	
2.	OT Delta T:	2/4 [0.5]	
3.	Loss of flow:	2/3/loop [0.5]	
4.	Rcp bus low volts:	1/2 busses [0.5]	
5.	RCP bus low freq.:	1/2 busses [0.5]	
6.	RCP breaker open:	1/2 breaker [0.5]	(3.0)

REFERENCE
KNP Training Manual IV-11.27

ANSWER 3.05 (4.00)

a. 1. 15 F (0.75)
2. 30 F (0.75)

b. Turbine trip controller. (0.75)

c. Load rejection controller. (0.75)

d. Provides a blocking signal for 10 valves during cooldown below low - low Tave setpoint (i.e. uncontrolled cooldown). (1.0)

REFERENCE
KNP System Description 6
KNP Training Manual IV-9, 12
KNP Logic Diagram XK100-153

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 3.06 (2.50)

a. The turbine serves as the heat sink to the reactor [0.3], thus a Rx trip should follow a turbine trip to minimize the RCS pressure and temperature peaks [0.7]. (1.0)

b. Hi pressurizer pressure [0.7] ~~and either of the following level trips or Delta T~~ OT Delta T [0.3] (1.0)
~~overpower~~

c. All turbine stop valves shut [0.25]
Auto Stop Oil pressure low (< 45 psig) [0.25] (0.5)

REFERENCE
KNP Training Manual IV-11.14

ANSWER 3.07 (3.50)

a. 1. The control rods would move in at max speed due to Tave-Tref deviation [0.75].
2. The steam dump would not arm on 1st stage press. transmitter failure ~~and trip on high Tave signal~~ (PM 486 provides arming signal) ~~steam dumps will shut when 2/3 Tave reaches Low-Low setpoint~~ [1.0].
3. The programmed level would increase to ~~100%~~ 50% due to high Tave signal [0.75]. (2.5)

b. The plant would trip on low pressurizer pressure [0.5] ~~due to~~ stat
the ~~large cooldown from the steam dumps and~~ rod insertion [0.5] (1.0)
due to Stm Dump not actuating will also accept trip from OTΔT setpoint (auto) reduction due to ΔI on rod insertion (0.25)

REFERENCE
KNP Training Manual IV-3, 7, 9, 12

ANSWER 3.08 (3.00)

a. True (0.5)

b. A low temperature would indicate insufficient spray flow (through the bypass valves). (1.0)

c. Control Room [0.5]
Aux feed pump station [0.5]
Charging pump station [0.5] (1.5)

REFERENCE
KNP Annunciator Response Book 47021-21

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 4.01 (3.00)

a. - High RCP Bearing Water Temperature
- #1 seal leakoff temperature high (1.0)

b. - Seal injection flow between 8 and 13 gpm [0.4]
- #1 seal leakoff flow less than 1 gpm [0.4]
- RCS pressure < 1000 psig [0.4]
- Plus either of the alarms above [0.4] (2.0)

REFERENCE
KNP Operating Procedures; N-RC-36A, p. 5

ANSWER 4.02 (2.20)

	FEDERAL	PLANT	
a.	1.25 REM or 3.0 REM if acc. dose not > 5(N-18)	1.25 REM	(0.75)
b.	7.5 REM	7.5 REM	(0.5)
c.	18.75 REM	18.75 REM	(0.5)

d. When through HIS own actions he has been successful in eliminating all unnecessary radiation exposure. (0.45)

REFERENCE
KNP Radition Protection Training Manual; Generic III-21, 27, 28
Plant Specific I-1

ANSWER 4.03 (3.50)

a. - Steam release from 1 S/G [0.5]
- Average readings of core T/C is constant (or decreasing) and is substantually below Tsat. [0.5] (1.0)

b. 25 F per hour (0.5)

c. Begin Emergency Boration. (1.0)

d. This minimizes the possibility of head voiding. (1.0)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

REFERENCE
KNP Operating Procedures; N-O-06

ANSWER 4.04 (2.50)

No [0.5], accumulated penalty over the past 24 hours is 95 minutes [1.0]. Assuming no further operation outside the Delta-I band, the penalty will be reduced to 60 minutes at 1614 Hrs. on 6/19/84 and then power may be increased [1.0]. (2.5)

REFERENCE
KNP Technical Specifications; 3.10

ANSWER 4.05 (4.00)

a. 1. Unexpected S/G level rise.
2. High radiation on S/G blowdown.
3. High radiation by chemistry sample.
4. High steam line radiation. [any 3, 0.4 each] (1.2)

b. 1. Stop all feed.
2. Shut MSIV and Bypass.
3. Verify PORV's shut.
4. Shut steam valve to TDAFWP. [0.4 each] (1.6)

c. 1. Shut the MSIV on the unaffected S/G
2. Cooldown using the PORV's on the uaffected S/G
---------- (CAF)
NOTE: Utility is to provide reference material for credit. (1.2)

REFERENCE
KNP Operating Procedures; E-O-09, pp 2-4

ANSWER 4.06 (2.80)

a. 1. RCS subcooling > 50 deg. AND
2. Pzr level > 50% AND
3. ~~AFW flow > 350 gpm on~~ level in at least 1 S/G in NR AND
4. RCS pressure > 2000 # [0.4 each] (1.6)

b. 1. RCS pressure decreases below 1815 psig OR
2. Pzr level drops below 20% OR
3. RCS subcooling < 50 deg. (1.2)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

REFERENCE
KNP Operating Procedures; E-0-10, p. 2

ANSWER 4.07 (4.00)

a. (5 of 7 required)
   1. Pressure indications on failed channel read high.
   2. Pressurizer pressure high alarm.
   3. Pressurizer heaters off.
   4. Both spray valves open.
   5. Pressurizer high pressure deviation alarm.
   6. Pressurizer pressure high reactor trip alarm.
   7. Actual pressure indication decreasing [0.3 each] (1.5)

b. 1. Both spray valves open.
   2. Pressurizer heaters off. (1.0)

c. 1. Close both pressurizer spray valves ~~and heaters off.~~
   2. Check pressurizer pressure indications.
   3. Position selector switch to remove failed channel from control. (1.5)

REFERENCE
KNP Annunciator Response Book; 47021-33, 42, 43

ANSWER 4.08 (3.00)

a. Less than 350 F [0.5] and 425 psig [0.5] (1.0)

b. 1. Throttled
   2. Throttled (auto)/a closed
   3. Closed
   4. Open
   5. Open (2.0)

REFERENCE
KNP Operating Procedures; N-0-05
N-RHR-34
KNP Flow Diagrams; XK100-18, 19

U. S. NUCLEAR REGULATORY COMMISSION
SENIOR REACTOR OPERATOR LICENSE EXAMINATION

Reviewed by
F. Stanazak
R. Iube
J. Brown
D. Braun

FACILITY: KEWAUNEE

REACTOR TYPE: PWR

DATE ADMINISTERED: 84/09/17

EXAMINER: PICKER, B.

APPLICANT: MASTER COPY

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

CATEGORY VALUE	% OF TOTAL	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	25.00			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00	25.00			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	25.00			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	25.00			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.00	100.00			TOTALS

FINAL GRADE _____%

All work done on this examination is my own. I have neither given nor received aid.

_____
APPLICANT'S SIGNATURE

QUESTION 5.01 (2.50)

Redistribution is a term associated with the coolant density decrease, as heat is carried away from the fuel rods, by the coolant passage upward through the core.

a. How does Redistribution effect flux distribution over core height at full power? (1.0)

b. What two effects further accentuate Redistribution at End of Life, power conditions? (1.5)

QUESTION 5.02 (3.00)

a. Why is the primary system flowrate approximately 10 times greater than secondary system flowrate? (1.5)

b. Why is a primary heat balance considered less accurate than a secondary heat balance? (1.5)

QUESTION 5.03 (4.00)

a. Compare Xenon-135 and Samarium-149 fission product poisons by EXPLAINING the differences for the following: (actual values are not necessary)

1. Time to reach equilibrium conditions after startup. (1.0)
2. Magnitude of negative reactivity at equilibrium conditions. (1.5)

b. Explain why the following statement IS or IS NOT true. 'Equilibrium Xenon concentration at 50% power is NOT approximately half its concentration at 100% power'. (1.5)

QUESTION 5.04 (3.00)

A reactor has the following characteristics:

1. Power defect = 1000 pcm
2. Total Rod Worth = 7000 pcm
3. Shutdown Rod Worth = 2000 pcm
4. Equilibrium Xenon = 2800 pcm
5. Peak Xenon = 5200 pcm

The reactor has been operating at steady-state for three weeks when a trip from 100% power occurs and the shutdown rods are pulled two hours later. Assume no boration by the operator.

a. What is the shutdown margin (SDM) immediately following the trip? (1.0)

b. What is the SDM eight hours after the trip? (1.0)

c. What is the SDM three days after the trip? (1.0)

QUESTION 5.05 (1.20)

When a pressurizer PORV is used to depressurize the RCS (during a S/G tube rupture recovery) you should expect to see pressurizer level (INCREASE, DECREASE, or REMAIN THE SAME). WHY? (1.2)

QUESTION 5.06 (2.80)

a. For each of the coefficients below: How do they vary over core age and Why?

   1. Moderator Temperature Coefficient. (1.0)
   2. Doppler Coefficient. (1.0)

b. What are the approximate values in PCM for each coefficient in (a) above over core life (BOL to EOL 100% pwr.)? (0.8)

QUESTION 5.07 (3.00)

Assume one RCP trips at 30% power, without a reactor protection system actuation or a change in turbine load. Indicate whether the following parameters will INCREASE, DECREASE, or REMAIN THE SAME.

a. Flow in the operating reactor coolant loops. (0.6)

b. The ratio of core flow compared to the total loop flow. (Core Flow/Total Loop Flow) (0.6)

c. Reactor Vessel delta P. (0.6)

d. Core delta T. (0.6)

e. Operating loop steam generator temperature. (0.6)

QUESTION 5.08 (2.50)

The reactor is operating at 100% power and no steam generator tubes are plugged. Steam generator pressure is 770 psig and RCS Tave is 574 F. If 25% of the S/G tubes are plugged, how much change must take place in Tave of the RCS in order to maintain the S/G pressure at 770 psig, when the reactor power is at 100%? Show all Work. Use the Steam Tables. (2.5)

QUESTION 5.09 (3.00)

Core operating limits and procedures are closely related to full length rod positioning parameters thus establishing Rod Operational Limits. Name the THREE positioning parameters and BRIEFLY explain the purpose of each. (3.0)

QUESTION 6.01 (3.00)

a. List FOUR of the six conditions when Steam Generator Blowdown is automatically isolated, AND the reason(s) isolation is desired for each condition selected. (2.0)

b. Fill in the blanks for the following statements concerning "special operation" of the blowdown system.

1. The condensate cooling return from the SGB Heat Exchangers can be diverted to the ____ if the heater drain tank becomes unavailable.

2. Blowdown flow can be diverted to the ____ should condensate become unavailable for cooling the SGB Heat Exchangers. (1.0)

QUESTION 6.02 (3.50)

a. What are ALL the parameter inputs for each of the following controls, AND indicate which inputs have selectable channel capability?

1. Main Feed Regulating Valve (MFRV).

2. Feedwater Regulating Bypass Valve. (2.0)

b. What are the THREE MFRV automatic closure signals AND the reason/basis for each closure signal? Setpoints not required. (1.5)

QUESTION 6.03 (3.00)

Describe the interlocks associated with the following valves.(Include setpoints)

a. RHR pump discharge to SI pumps.

b. RHR suctions from Sump B.

c. Hot leg supplies to RHR. (3.0)

QUESTION 6.04 (3.00)

The reactor is operating at 100% power with all systems in normal. For the following failures, what reactor protective signal will cause the reactor to trip? Assume no operator action and consider each failure independently. BREIFLY EXPLAIN YOUR ANSWER.

a. CVCS charging flowrate drops to the minimum value. (1.5)

b. A (controlling) cold leg temperature detector fails high. (1.5)

QUESTION 6.05 (3.50)

a. Describe how the Spent Fuel Pool (SFP) leak collection system design provides for leak detection and location. (1.5)

b. What design features of the SFP mitigate/prevent siphoning the pool from a leak/rupture in SFP pump suction AND return piping? (1.0)

c. Other than thermal capacity considerations, how has the storage capacity of the SFP been increased? (1.0)

QUESTION 6.06 (2.00)

a. What is the purpose of the Reactor Vessel Head Venting System (RVHVS)? (1.0)

b. State the purpose(s) of the orifice installed in the RVHVS vent lines. (1.0)

QUESTION 6.07 (3.00)

a. Describe the response (sequence of events) of a 4160 Volt Safeguards Bus to maintain/restore electrical power when an undervoltage condition on a safeguards bus COINCIDENT with a Safety Injection Signal exists. (1.0)

b. State ALL the conditions that must be met to allow the EDG output breaker to automatically shut. (1.0)

c. Why are the two 4160V feeder breakers for Feedwater and RCP's tripped in addition to the two bus power supply breakers when a fault condition exists on bus 1-1? (0.5)

d. If the Emergency Diesel Generator is operating, how is its continued operation affected by a cardox fire protection actuation signal? (0.5)

QUESTION 6.08 (2.00)

a. How is RBV fan-coil unit operation affected by a Safety Injection Signal? (1.0)

b. Explain how normal fan-coil unit operation automatically changes when one of the units in a pair is stopped. (1.0)

QUESTION 6.09 (2.00)

a. What input signals are sent to the computer for use in calculating rod insertion limits? (1.0)

b. What are the three design bases for the rod insertion limits? (1.0)

QUESTION 7.01 (3.00)

a. Who, by title or position, must sign an 'Authorization for Increased Radiation Exposure' to increase an individual's dose limit above 1250 mREM/Q and WHY is each signature required? (1.5)

b. What are the THREE types of RWP's used other than for emergencies AND for what time period is each valid? (1.5)

QUESTION 7.02 (3.50)

Assume that your plant has undergone a Loss of Secondary Coolant Accident and your operators have reached a condition where the SI system can be stopped under EITHER of 2 sets of conditions.

a. What is the difference between the 2 conditions? (1.5)

b. When would SI be required to be manually reinitiated? (2.0)

QUESTION 7.03 (3.50)

a. Under Postaccident Conditions whose approval, by title, is required prior to operating the systems listed in the procedure 'Postaccident Systems Operation', E-0-12? (1.5)

b. Under what TWO conditions should the Head Vent system NOT be used per the procedure Precautions and Limitations? (2.0)

QUESTION 7.04 (3.50)

Answer the following questions about "Natural Circulation Operation", procedure N-O-06.

a. Provide the TWO methods of determing effective natural circulation. (1.0)

b. What is the maximum cooldown rate allowed and the basis for this rate? (1.0)

c. What action are you required to take if one control rod indicates not fully inserted? (0.5)

d. While performing a cooldown in natural circulation, why are the RCS subcooling requirements much more restrictive if the Control Rod Drive Mechanism cooling units are not in operation? (1.0)

QUESTION 7.05 (4.00)

a. List FIVE of the seven immediate symptoms of the controlling pressurizer pressure channel failing high, while at power. (1.0)

b. What automatic control actions will occur as a result of this failure? (1.5)

c. What 3 manual actions are required? (1.5)

QUESTION 7.06 (3.00)

a. What are FOUR responsibilities of the Shift Supervisor during an emergency according to EP-AD-1, "Plant Emergency Organization"? (2.0)

b. During an emergency WHO, by title, is the primary relief for the Shift Supervisor as Emergency Director and HOW is the relief documented? (1.0)

QUESTION 7.07 (2.10)

Complete the following precautions and limitations from procedure N-O-05 "Plant Cooldown from Hot Shutdown to Cold Shutdown Condition".

a. One steam generator shall be operable whenever the average reactor coolant temperature is above ____ F.

b. At least ___ pressurizer safety valve shall be operable whenever the reactor head is on the reactor pressure vessel.

c. Pressurizer cooldown rate shall not exceed ___ F per hour.

d. The secondary side of the steam generator must not be pressurized above ___ psig if the temperature of the steam generator is below __ F.

e. During cooldown temperature difference between the pressurizer and the reactor coolant shall be greater than ___ F except when filling the pressurizer.

f. Maintain the temperature difference between the loops at less than __ F during cooldown. (2.1)

QUESTION 7.08 (2.40)

a. What are FOUR conditions that MUST be met during the release of gaseous waste? (2.0)

b. Who must the Shift Supervisor notify prior to and at the completion of a gaseous waste discharge? (0.4)

QUESTION 8.01 (3.70)

a. Is it permissible by Tagout Control Procedure ACD 4.3 to re-use a danger tag? EXPLAIN. (1.0)

b. List the FOUR conditions in ACD 4.3, which allow for exception of a required physical independent verification on the restoration of cards. (1.2)

c. Who by position/title can authorize removal of hold cards when the person that ordered them placed is not on site and cannot be reached? (1.0)

d. How is an independent verification documented? (0.5)

QUESTION 8.02 (3.50)

a. List FIVE different examples of a reportable incident as defined in ACD 2.16. (2.5)

b. What specific responsibility remains for the Shift Supervisor after the incident has been recognized and an incident report has been initiated? (1.0)

QUESTION 8.03 (2.40)

What THREE conditions must be met in order for the Shift Supervisor to authorize/approve a restart from an unscheduled reactor shutdown? (2.4)

QUESTION 8.04 (3.00)

a. What are the approval requirements for implementing a Temporary Operating Procedure? (1.5)

b. What is the maximum time period a Temporary Operating Procedure is valid? (0.5)

c. When is the Temporary Operating Procedure control sheet and form NOT required to document a change? (1.0)

QUESTION 8.05 (2.40)

What is the Standing Order policy/practice which allows electrical penetration openings to remain open during non-working hours? (2.4)

QUESTION 8.06 (2.00)

When the automatic trip of the RCP on a SI was removed the commitment for two licensed operators in the 'Control Room' was re-implemented. What are the 'Control Room' boundaries as defined by this Standing Night Order? (2.0)

QUESTION 8.07 (3.00)

a. For each of the following leak locations, give the maximum allowable rate of leakage of reactor coolant as specified in the Technical Specifications.

   1. Unknown location.

   2. RHR valve packing leak with leakoff line.

   3. Through a wall crack in the line between the pressurizer code safety valve and the pressurizer.

   4. Steam generator tubes. (1.2)

b. What is the basis for the Technical Specification limit on maximum reactor coolant activity? Include operator action assumptions made in the basis. (1.8)

QUESTION 8.08 (2.50)

a. Shutdown margin (SDM) must meet Technical Specifications figure (3.10-1) requirements while in hot shutdown conditions. What specific accident is this figure designed to provide protection for? (0.5)

b. While maintaining 50% turbine load, with control rods in automatic, a 50 ppm boron dilution takes place. What effect does this have on SDM? (1.0)

c. List the parameters used for calculation of SDM when at power. (1.0)

QUESTION 8.09 (2.50)

a. What are the steady state AND transient Technical Specification limits for the RCS chemistry parameters listed below?

1. Dissolved Oxygen (>250 F)
2. Chloride
3. Floride (1.5)

b. Why are the above transient limits different than the steady state limits? (1.0)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 5.01 (2.50)

a. The flux distribution is skewed towards the bottom of the core (due to MTC effects) (1.0)

b. 1. Core depletion with Bank D partially inserted [0.75]
2. Moderator Temperature Coefficient becomes more negative with core depletion (because of removal of boron from the coolant to compensate for burnup) [0.75]. (1.5)

REFERENCE
KNP Training Manual; I-6.31

ANSWER 5.02 (3.00)

a. Due to the CHANGE IN PHASE on the secondary side of the steam generator, its enthalpy rise is roughly ten times the primary side enthalpy drop. Since the ENERGY GAINED by the feedwater MUST be EQUAL to THE ENERGY RELEASED from the primary system,

(m dh) primary = (m dh) secondary

the primary mass flow rate must be approximately ten times the secondary system flow rate. (1.5)

b. Due to the large secondary enthalpy change [0.75], the percent error from temperature, pressure, and flow sensitivity is smaller [0.5]. Also, primary system flow instruments are very inaccurate [0.25]. (1.5)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR I
Chapter 1, pp. 19-22

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 5.03 (4.00)

a. 1. Samarium takes much longer to reach equilibrium conditions [0.5] because it is formed by decay of a precursor with a longer half life than for Xenon [0.5]. (1.0)

2. Xenon has the most worth at equilibrium [0.5] because it is more abundant [0.5] and because it has a higher neutron absorbtion cross-section [0.5] (1.5)

b. True [0.5], Equilibrium Xenon is flux dependent and non-linear [0.5] since burnout is relatively less significant at 50% power than at 100% power (production is flux dependent but removal terms are not both flux dependent) [0.5] (1.5)

REFERENCE
Kewaunee Nuclear Plant Training Manual (WNTO-7606) I-6.39-46

ANSWER 5.04 (3.00)

a. Initial Rect = 0.000
Rods = -.070
Power Defect = +.010

0.06 delta-K or 6000 pcm shutdown (1.0)

b. -0.060
S.D. Rods = +0.020 (optional - may not include due to T.S. def. of SDM)
Xenon = -0.024

0.064 delta-K or 6400 pcm shutdown (1.0)

c. -0.064
Xenon = +0.052

0.012 delta-K or 1200 pcm shutdown (1.0)

No penalty if 1 rod is considered stuck or if S.D. rod worth not Considered if done consistantly due to T.S. definition of SDM

REFERENCE
Reactor Theory Manual, Chapter 9

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 5.05 (1.20)

An increase is expected as liquid replaces the escaping steam. (Also accept an explanation of swell phenomenon) (1.2)

REFERENCE
KNP Training Manual (WNTO-7803) II-1.4

ANSWER 5.06 (2.80)

a. 1. MTC becomes more negative [0.5] -- because as born is reduced over core life (due to fuel depletion) the positive effect of 1 F change in boron concentration is reduced (as temp. increases, density decreases thus more boron is removed from the core) [0.5],

OR

neutron leakage is increased due to the radial flux shift outward at EOL [0.5]. (1.0)

2. DOPPLER COEFFICIENT -- gets less negative [0.5] due to the decrease in fuel to clad gap [0.3] (clad creep) because of increased heat transfer and reducing the effect of fuel temperature [0.2]. (1.0)

b.

	BOL [0.2 each]	EOL [0.2 each]	
MTC	~~-16.4~~ -4 (+/-) 2 PCM/ F	~~27~~ -31 (+/-) 3 PCM/ F	Corrected for cycle 9 data
Doppler	-1~~2~~.5 (+/-) 3 PCM/%	-11 (+/-) 2 PCM/%	

(0.8)

REFERENCE
KNP Training Manual, I-6.2-18

ANSWER 5.07 (3.00)

a. Increase
b. Decrease
c. Decrease
d. Increase
e. Decrease [0.6 each] (3.0)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR II Chapter 12, pp. 15-16

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 5.08 (2.50)

Steam Generator Heat Transfer: Q=UA delta T [0.5]
where delta T = Tave - Tsat (sec)

Q, U, and Tsat (sec) remain constant, therefore,

Q/A = A1[Tave 1 - Tsat (sec)] = A2[Tave 2 - Tsat (sec)] [0.5]

From given info. A2=0.75 A1

From Steam Tables: Tsat (sec) = 512-516 F [0.7]

A1 (574 - 514) = 0.75 A1 (Tave 2 - 514) Tave 2 = 594 F

Therefore: Tave must increase by 19-21 F [0.8] (2.5)

REFERENCE
Westinghouse Thermal-Hydraulic Principles and Applications to PWR I
Chapter 6

ANSWER 5.09 (3.00)

a. WITHDRAWAL LIMIT [0.5] - Imposed to help avoid dumping steam if a decrease in power is initiated. [0.5] (1.0)

b. MANEUVERING BAND [0.5] - To allow an immediate return to full power at anytime from a lower power [0.25] as well as to help maintain a fairly even axial fuel depletion [0.25] (1.0)

c. INSERTION LIMITS [0.5] - Assures the ability to shutdown at any-time, under any conditions [0.5] (1.0)

REFERENCE
KNP Training Manual (WNTD-7606) I-6.30

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 6.01 (3.00)

a. 1. RMS R-15, S/G tube rupture and radiation releases

2. RMS R-19, S/G tube rupture and radiation releases

3. AFW pump start, (loss of main feed) maximize AFW flow (~200 gpm AFW- ~80 gpm BD)

4. Containment isolation, accident conditions- radiation release

5. BD tank high pressure, tank overpressure protection

6. BD Heat Exchanger high temperature, protect the ion exchanger

[0.5 each, 4 required] (2.0)

b. 1. Condenser hot well

2. S/G Blowdown tank [0.5 each] (1.0)

REFERENCE
KNP System Description Vol I, Chapter 7.

ANSWER 6.02 (3.50)

a. 1. P-impulse

S/G level

S/G pressure

Feedwater flow *

Steam flow *

2. S/G level

[0.3 each, 0.1 selectable (*)] (2.0)

b. 1. Hi-Hi S/G level--protect turbine from water carryover.

2. Rx trip & Low Tave--prevent excessive cooldown of RCS.

3. SI--reduce cooldown of RCS to reduce the consequences of accident.

[0.5 each] (1.5)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

REFERENCE
KNP System Description Vol I, Chapter 5.

ANSWER 6.03 (3.00)

a. Cannot be opened unless RHR discharge pressure is <210 psig and SI pump suction valves are closed.

b. Cannot be opened unless one of two SI recirc test line valves is closed.

c. Cannot be opened unless RCS pressure is <450 psig AND auto close if RCS pressure reaches 700 psig.

[1.0 each] (3.0)

REFERENCE
KNP System Description Vol II, Chapter 34.

ANSWER 6.04 (3.00)

a. High PZR level [0.5] Letdown is greater than makeup, therefore Pzr level decreases and letdown isolates. Then makeup is greater than letdown and Pzr level increases to the High Level Trip [1.0] (1.5)

b. Low PZR pressure [0.5] Rods insert, Tavg decreases, PZR level and pressure decreases to the Low Pressure Trip. [1.0]. (1.5)

REFERENCE
KNP Training Manual Section IV- 3,7,11,12.

ANSWER 6.05 (3.50)

a. The leak collection system consists of channels behind the SFP seam welds and is divided into several zones. Should any zone develop a leak, a dye solution can be used to flood the affected zone detecting the leakage source by visual observation of the dye passing into the pool. (1.5)

b. Check valves on the return lines and the penetration height of the suction lines. (1.0)

c. Adding boron carbide to the racks and reducing the space between storage assemblies. (1.0)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

REFERENCE
KNP System Description 21, pp 5-6

ANSWER 6.06 (2.00)

a. To remove non-condensible gases or steam from the reactor vessel head. (1.0)

b. To limit the flow (in the event of an inadvertant openins or rupture of vent valves/lines) ~~to within the corocitu e of one charging pump.~~ ~~SAF FOR ADDITIONAL INFORMATION.~~ (1.0)

REFERENCE
KNP Operating Procedures; E-0-12, N-RC-36D
KNP Flow Diagrams XK100-10

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 6.07 (3.00)

a. The safety injection signal blocks the shutdown sequencer and sheds the non-safety loads [0.2]. The undervoltage signal blocks the LOCA sequencer and sheds ALL of the loads [0.2]. The EDG automatically starts and when the diesel is up to speed and and voltage the output breaker shuts [0.2]. Then the LOCA sequencer is actuated and the required loads are sequenced on [0.2]. CAF (1.0)

b. 1. BOTH feeder breakers to the associated ESF bus are open

2. Diesel generator master transfer switch is in auto

3. Generator is up to voltage

4. Generator is up to speed

5. No lockout relays energized for that ESF bus

6. Bus De-energized (UV) CAF (1.0)

c. To initiate a reactor trip signal as fast as possible on loss of supply to the RCP. (0.5)

d. Automatically tripped. (0.5)

REFERENCE
KNP System Description Vol I, Chapter 10 pp10-12,
Vol II, Chapter 42, p. 13,
Chapter 39, p. 6
KNP Surveillance Procedure 33-110.

ANSWER 6.08 (2.00)

a. All four units automatically start [0.5] and service water bypasses modulating valves through high capacity two-position valves [0.5]. (1.0)

b. Duct damper interlock directs air flow to only pump vaults. (1.0)

REFERENCE
KNP System Description Vol II, 18, pp 2, 13

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 6.09 (2.00)

a. Power input-- delta T [0.5]
Rod height-- DEMAND bank position [0.5]
(Tave-factor set to zero-not required for full credit) (1.0)

b. Insure adequate shutdown margin
Minimize severity of ejected rod accident
Provide acceptable nuclear peaking factors (FdeltaH) (1.0)

REFERENCE
KNP Training Manual, Section IV-6.

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 7.01 (3.00)

a. 1. Radiation Protection Supervisor [0.3]: Insures that all data is correct and recored properly [0.2].

2. Authorized Rep. of the Individual's employer [0.3]: To ensure the employer is aware of the exposure their employees are receiving [0.2].

3. The Individual [0.3]: To insure that he is aware that his administrative exposure limit is being increased [0.2]. (1.5)

b. 1. REGULAR -- Not to exceed one month [0.5]

2. Extended -- Not to exceed one month [0.5]

3. Special -- duration of Task [CAE] [0.5] (1.5)

REFERENCE
KNP Radiation Protection Training Manual; Plant Specific I-3, II-1

ANSWER 7.02 (3.50)

a. DIFFERENCES:

One hot leg above 350 F	VS.	Both above 350 F	
Press. > 700 psig and stable or increasing	VS.	Press. > 2000 psig stable or increasing	
PZR level > 20% and increasing	VS.	PZR level > 20%	(1.5)

b. 1. PZR press. decreases more than 200 psi OR
2. PZR level drops below 20% OR
3. Reactor coolant subcooling is < 50 F OR
4. Containment pressure, radiation, sump levels show abnormally high or increasing reading. (2.0)

REFERENCE
KNP Operating Procedures; E-0-08, p. 3

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 7.03 (3.50)

a. With the CONCURRENT approval of the Shift Supervisor AND Event Operations Director. (1.5)

b. 1. If as a result of a controlled natural circulation cooldown a void in the reactor vessel upper head is expected [1.0].

2. If the Safety Injection Pumps are operating [1.0] (2.0)

REFERENCE
KNP Operating Procedures; E-0-12, p. 1

ANSWER 7.04 (3.50)

a. - Steam release from 1 S/G [0.5]
- Average readings of core T/C is constant (or decreasing) and is substantually below Tsat. [0.5] (1.0)

b. 25 F per hour [0.5], to avoid upper head void formation [0.5] (1.0)

c. Begin Emergency Boration. (0.5)

d. This minimizes the possibility of head voiding. (1.0)

REFERENCE
KNP Operating Procedures; N-0-06

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 7.05 (4.00)

a. (5 of 7 required)
1. Pressure indications on failed channel read high.
2. Pressurizer pressure high alarm.
3. Pressurizer heaters off.
4. Both spray valves open.
5. Pressurizer high pressure deviation alarm.
6. Pressurizer pressure high reactor trip alarm.
7. Actual pressure indication decreasing [0.2 each] (1.0)

b. 1. Both spray valves open.
2. Pressurizer heaters off.
3. Possible SI (or trip from low pressurizer pressure) (1.5)

c. 1. Close both pressurizer spray valves ~~and heaters off.~~
2. Check pressurizer pressure indications.
3. Position selector switch to remove failed channel from control. (1.5)

REFERENCE
KNP Annunciator Response Book; 47021-33, 42, 43

ANSWER 7.06 (3.00)

a. (4 of 5 required)
1. Evaluate plant conditions and determine if an emergency condition exits [0.5].

2. Direct and coordinate the initial response to the emergency, to control and limit its effects [0.5].

3. Initiating required notifications as to the nature and classification of the emergency [0.5].

4. Performing any other initial functions of the Emergency Director (ED) until relieved by a designated ED [0.5].

5. Provide info. and make recommendations to the EOD or ED and obtaining their concurrence before making changes in plant operations [0.5]. (2.0)

b. Plant Manager [0.5]; relief is documented in the Shift Supervisor's log book [0.5] (1.0)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

REFERENCE
KNP Emergency Plan Implimenting Procedures; EP-AD-1, p. 1
EP-AD-5, p. 1

ANSWER 7.07 (2.10)

a. ~~250~~ 350 F → later revision of procedure April 10, 1984
b. one
c. 200 F
d. 200 psig, 70 F
e. 100 F
f. 25 F [0.3 each] (2.1)

REFERENCE
KNP Operating Procedures; N-0-05, pp 1-2

ANSWER 7.08 (2.40)

a. 1. The gross activity monitor shall be operable. (Iodine and particulate samplers) (0.5)

2. Automatic isolation device shall be operable. (0.5)

3. The gross halogen and particulate activity of all gaseous waste released shall be monitored and recored. (0.5)

4. For effluents without continous monitoring the release activity and volume shall be monitored and recorded. (0.5)

b. Radiation Protection Group (0.4)

REFERENCE
KNP Operating Procedures; N-GWP-32B, p. 1
KNP Adminstrative Control Directive; ACD 6.6, p. 1

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 8.01 (3.70)

a. Yes [0.5], with Shift Supervisor approval [0.25] to allow for temporary energizing of equipment for testing/operation [0.25]. (1.0)

b. 1. Indirect indication (status light, annunciator, etc.).
2. Significant radiation exposure (>1000 mR/hr).
3. Post work functional testing (prove correct alignment).
4. System checklist completed prior to operability requirement for outage related work. [0.3 each] (1.2)

c. Plant Manager or Acting Plant Manager (1.0)

d. A checkmark (✓) on the original tagout control sheet. (0.5)

REFERENCE
KNP ACD 4.3, pp 3,7,8.

ANSWER 8.02 (3.50)

a. 1. Theft/loss of licensed material.
2. Over exposure and/or excessive levels and concentration.
3. Defect or non-compliance.
4. Exceeding a TS LCO or safety unit.
5. Immediate notification.
6. Reportable event.
7. Security event.
[5 required, 0.5 each] (2.5)

b. Determine if event requires NRC notification.(10CFR50.72,73.71) (1.0)

REFERENCE
KNP ACD 2.16

ANSWER 8.03 (2.40)

1. All problems resolved, and
2. Equipment malfunctions resolved, and
3. Cause of trip positively determined. [0.8 each] (2.4)
4. Also accept completion of checklist N-ESF-55

REFERENCE
KNP ACD 4.1, N-ESF-55, E-0-04.

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

ANSWER 8.04 (3.00)

a. Approval signatures of two members of Plant Supervisory Staff [0.75], one of which must be a licensed SRO [0.75] (1.5)

b. Six weeks. (0.5)

c. Not required for checklist changes. (1.0)

REFERENCE
KNP ACD 4.2.

ANSWER 8.05 (2.40)

1. Openings kept as small as possible.
2. Opening is overstuffed with cerafiber (to provide a fire barrier)
3. Establish a fire watch per TS. (2.4)

REFERENCE
KNP Standing Night Orders.

ANSWER 8.06 (2.00)

Control room-including kitchenette [0.5], lavatory [0.5], SS office [0.5], and relay room [0.5]. (2.0)

REFERENCE
KNP Standing Night Orders.

ANSWER 8.07 (3.00)

a. 1. 1 gpm
2. 10 gpm
3. 0 gpm
4. 500 gpd through any one S/G. [0.3 each] (1.2)

b. The potential release of activity to the atmosphere is below limits to protect the public [0.6] in the event of a (worst credible) S/G tube rupture [0.6] if the faulty S/G is isolated within 1/2 hr after the event [0.6]. (1.8)

ANSWERS -- KEWAUNEE -84/04/17-PICKER, B.

REFERENCE
KNP TS pp 3.1-9 and 3.1-11.

ANSWER 8.08 (2.50)

a. Steamline break [0.4] at EOL [0.1]. (0.5)

b. SDM is reduced. (1.0)

c. 1. Rod Position
2. Rx Power
3. RCS Temperature
4. Xenon and Samarium concentrations. ~~(CAF)~~ (1.0)

~~NOTE: Utility is to provide reference material for (c) for credit.~~

REFERENCE
KNP TS 3.10 and basis.

ANSWER 8.09 (2.50)

a.

		STEADY STATE	TRANSIENT		
1.	Oxygen	0.1 ppm	1.0 ppm		
2.	Chloride	0.15 ppm	1.5 ppm		
3.	Floride	0.15 ppm	1.5 ppm	[0.25 each]	(1.5)

b. Since (stress) corrosion is time AND temperature dependent, time (24 hrs.) is allowed to restore chemistry parameters prior to taking action. (1.0)

REFERENCE
KNP TS 3.1e.