U. S. NUCLEAR REGULATORY COMMISSION REGION I
OPERATOR LICENSING EXAMINATION REPORT

EXAMINATION REPORT NO. 50-286/85-06(OL)

FACILITY DOCKET NO. 50-286

FACILITY LICENSE NO. DPR-64

LICENSEE: Power Authority of the State of New York
Indian Point 3 Nuclear Power Plant
P. O. Box 215
Buchanan, New York 10511

FACILITY: Indian Point 3

EXAMINATION DATES: April 23-26, 1985

LEAD EXAMINER: D W Johnson — Lead Reactor Engineer (Examiner) — 6/10/85 Date

REVIEWED BY: RM Keller — Chief, Project Section 1C — 6/10/85 Date

APPROVED BY: HB Kister — Chief, Project Branch No. 1 — 6/11/85 Date

SUMMARY: Written and oral examinations were administered to six RO candidates and 5 SRO candidates. All candidates passed the operating examination, however, one SRO candidate failed the written examination.

REPORT DETAILS

TYPE OF EXAMS: Replacement

EXAM RESULTS:

	RO Pass/Fail	SRO Pass/Fail
Written Exam	6/0	4/1
Oral Exam	6/0	5/0
Simulator Exam	6/0	5/0
Overall	6/0	4/1

1. CHIEF EXAMINER AT SITE: A. J. Vinnola, Jr.

2. OTHER EXAMINERS: R. M. Keller, NRC, Region 1
P. T. Isaksen, EG&G, Idaho
R. L. Sailor, EG&G, Idaho

3. SUMMARY OF GENERIC DEFICIENCIES NOTED ON ORAL/SIMULATOR EXAMS:

a. Reactor Operator (RO) candidates were not familiar with locations of reference data/procedures in the control room.

b. RO candidates were slow to locate some of the supervisory switches and specific meter parameters.

4. SUMMARY OF GENERIC DEFICIENCIES NOTED FROM GRADING OF WRITTEN EXAMS:

a. RO candidate knowledge of principles of nuclear power plant operation, thermodynamics, heat transfer and fluid flow is good.

b. More than one-half of the candidates lacked some knowledge in the following areas:

The effects of core burnup on the Moderator Temperature Coefficient.

The functions/purposes of the Emergency Diesel Generator Blower.

The closing motive forces for Main Steam Isolation Valves when the plant is at power.

The actions an operator is to immediately perform if the "Valve 730 or 731 not fully open" annunciator is received.

The purpose of steam dump interlocks.

The reason for the precaution of not adding hydrazine until the oxygen content in the volume control tank is less than 2%.

The criteria for approval of temporary changes to plant procedures.

The people that are required to authorize the installation of a jumper that defeats a trip or nuclear safety circuit in a non-emergency situation.

5. WRITTEN EXAMINATION REVIEW

At the conclusion of the written examination, the examiners met with the following facility personnel to review the master written examinations and answer keys to identify any inappropriate questions relative to plant specific design and to ensure that the questions elicited the answers in the key and that they reflect current plant conditions:

B. Ray, Nuclear Training Coordinator
C. Embry, Nuclear Training Specialist
C. Lambert, Nuclear Training Specialist
E. Diamond, Nuclear Training Specialist
R. Robenstein, Training Specialist

Verbal comments were received from the reviewers. The plant specific references that supported these comments were verified by the examiners and the comments were appropriately incorporated into the answer key during the review. No other verbal nor written comments were received by the examiners. Significant changes are listed in Attachment 2.

6. PERSONNEL PRESENT AT EXIT INTERVIEW:

NRC Personnel

P. Koltay, Resident Inspector
D. Coe, Reactor Engineer (Examiner)

NRC Contractor Personnel

A. Vinnola, EG&G, Idaho
P. Isaksen, EG&G, Idaho
R. Sailor, EG&G, Idaho

Facility Personnel

J. Brons, Resident Manager
J. Russell, Superintendent of Power
R. Robenstein, Training Specialist
R. Tansky, Training Superintendent
E. Diamond, Nuclear Training Specialist
C. Lambert, Nuclear Training Specialist

7. SUMMARY OF NRC COMMENTS MADE AT EXIT INTERVIEW:

Individuals who clearly passed the operating examination were identified.

Significant knowledge and ability weaknesses noted during the operating examination were presented.

The following general comments were also presented by the examiners:

a. Candidates had difficulty locating specific procedures within a binder because the procedures had misplaced pages and were not indexed like the procedures located in the control room.

b. The examiners expressed concern about the dissimilarities between the Indian Point 2 simulator used for examinations and the Indian Point 3 control room, because some of the candidates were slow to locate switches and meters that were either in dissimilar locations or were not identical between the two units. The examiners stated that the NRC Region I Office would follow up on this item.

Attachments:

1. Written Examination(s) and Answer Key(s) (SRO/RO)
2. Changes Made to Written Examinations During Exam Review

ATTACHMENT 1

MASTER COPY

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: INDIAN POINT 3

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/04/23

EXAMINER: SAILOR, B.

APPLICANT: _____

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	25.00	_____	_____	4.	PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
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 1.01 (3.00)

How will the following affect the Moderator Temperature Coefficient? BRIEFLY EXPLAIN your answer.

a. The BIT is inadvertantly injected into the RCS.

b. The core ages from BOL to EOL.

c. The RCS is cooled down from 550 F to 450 F. (3.0)

QUESTION 1.02 (2.50)

a. State TWO reasons why equilibrium Xenon has significantly more negative worth than does equilibrium Samarium in an operating reactor. (1.5)

b. State the approximate Xenon values (in pcm) for the present core cycle.

1) Steady state equilibrium Xenon at 100% power. (0.5)
2) Peak Xenon following a reactor trip from 100% power. (0.5)

QUESTION 1.03 (1.50)

Is a primary neutron source necessary to provide sufficient neutrons to start the initial chain reaction in a new core? BRIEFLY EXPLAIN your answer. (1.5)

QUESTION 1.04 (2.50)

a. Define Subcritical Multiplication (Factor) (M). (1.0)

b. Provide THREE evolutions for which a 1/M plot is utilized in a Pressurized Water Reactor. (1.5)

QUESTION 1.05 (1.50)

a. Which parameter below will have the MOST effect on the shape of a Differential Rod Worth Curve?

1) Core radial flux profile
2) Core axial flux profile
3) Core axial temperature profile
4) Time of core cycle (0.5)

b. What effect does having a bank overlap program have on the differential rod worth curve? (As compared to a differential rod worth curve for a rod program that does not use bank overlap.) (1.0)

QUESTION 1.06 (3.00)

Compare the CALCULATED Estimated Critical Position (ECP) for a startup to be performed 4 hours after a trip from 100% power, to the ACTUAL critical control rod position if the following events/conditions occurred. Consider each independently. Indicate whether the ECP is HIGHER than, LOWER than, or the SAME as the actual critical control rod position AND BRIEFLY EXPLAIN the reason for your answer.

a. The FOURTH coolant pump is started two minutes prior to criticality. (0.75)

b. The startup is delayed until 8 hours after the trip. (0.75)

c. The steam dump pressure setpoint is increased to a value just below the Steam Generator Atmospheric Dump (PORV) setpoint. (0.75)

d. All Steam Generator levels are rapidly being raised by 5% as criticality is reached. (0.75)

QUESTION 1.07 (3.00)

a. Provide the THREE conditions necessary for Brittle Fracture of a carbon steel pressure vessel to occur. (1.5)

b. Define RT NDT (Nil-Ductility Reference Temperature). (0.5)

c. How does RT NDT change as the reactor vessel ages? BRIEFLY EXPLAIN your answer. (1.0)

QUESTION 1.08 (1.50)

True or False?

a. One of the pump laws for centrifugal pumps states that the volume flow rate is proportional to the speed of the pump. (0.5)

b. As VCT temperature decreases, volume flow rate from the positive displacement (PD) pump increases. (0.5)

c. Pump runout is the term used to describe the condition of a centrifugal pump running with no volume flow rate. (0.5)

QUESTION 1.09 (2.00)

List FOUR methods to INCREASE the NPSH to a CVCS charging pump. (2.0)

QUESTION 1.10 (3.00)

Hot channel factors are measurable and their Technical Specification surveillance frequency requirements are relatively low provided four items are monitored and verified to be within their limits. Provide THREE of these four items (conditions). (3.0)

QUESTION 1.11 (1.50)

State the relationship between Reactor Power, RCS Delta T, and RCS Delta enthalpy (h). Discuss the validity of this relationship if the RCS Hot Leg temperature reaches saturation. (1.5)

End of category 1

QUESTION 2.01 (3.00)

a. Provide THREE Component Cooling (CCW) system alarms that could indicate a RCS to CCW leak. (1.5)

b. Describe, in detail, how the CCW system is protected against an overpressure condition if a RCS to CCW rupture occurred in the RCS Thermal Barrier. (1.5)

QUESTION 2.02 (2.50)

a. Indicate (by both loop number and COLD, HOT or INTERMEDIATE leg) where the following CVCS piping lines connect to the RCS.

1. Normal Letdown
2. Excess Letdown
3. Normal Charging
4. Alternate Charging (1.5)

b. Other than the Pressurizer Safety Valves or PORVs, provide FIVE other valves that relieve to the PRT. (1.0)

QUESTION 2.03 (3.00)

a. Name the chemicals used to control pH and OXYGEN for both the RCS and Steam Generating Systems during power operation. (2.0)

b. True or False?

The mixed bed demineralizers will remove fission products from the RCS. (0.5)

c. True or False?

Hydrazine is primarily used to control RCS pH when in cold shutdown. (0.5)

QUESTION 2.04 (3.50)

Refer to the RHR Drawing (Figure 2-1) to answer the following questions.

a. Where does this relief valve discharge to? (0.375)

b. Provide THREE interlocks associated with these valves. (1.5)
[Discuss the interlocks including setpoints]

c. What component does this piping line originate from? (0.375)

d. What system does this piping line supply? (0.375)

e. What system does this piping line supply? (0.375)

f. Provide the opening signal for these valves. (0.5)

QUESTION 2.05 (2.50)

a. Provide FOUR of the five signals that will automatically initiate Containment Ventilation Isolation. (No setpoints required.) [Do not include multi-channel signals as separate signals] (2.0)

b. True or False?

BOTH containment spray trains OR ALL (5) Containment FCUs OR ONE spray train and THREE FCUs are all possible combinations that will maintain containment conditions below their design limits during the injection phase of a LOCA. [Make a choice and discuss your reasoning] (0.5)

QUESTION 2.06 (2.50)

a. What are the TWO purposes of the ~~air supplied by the~~ Emergency D/G blower? [Deleted for clarity] (1.0)

b. What is the overall advantage of using a turbocharger on the D/G? (0.5)

c. What are the THREE adjustments that may be made with the adjustment knobs on the D/G Governor? (1.0)

QUESTION 2.07 (3.50)

a. What TWO sets of conditions will result in Containment Spray initiation? (No setpoints required.) (1.0)

b. BRIEFLY DESCRIBE the sequence of events that occur to provide Containment Spray flow (with additive) to the containment after an initiation signal is received. (1.5)

c. What is the additive to the Containment Spray? (0.5)

d. What is the overall purpose for using a spray additive? (0.5)

QUESTION 2.08 (2.50)

a. Complete the attached sheet (Figure 2.2) to show how steam is supplied to the Auxiliary Feed Pump Turbine (AFPT) from the Main Steam system. (Include all in-line valves that might isolate flow, relief valves, and indicate how all non-manual valves are actuated.) (1.5)

b. What TWO signals will automatically start the AFPT? (1.0) (No setpoints required.)

QUESTION 2.09 (2.00)

a. What forces are used for Main Steam Isolation Valve (MSIV)... (1.5)

1) Opening?
2) Closing (at power)?

b. What protection signal is generated from MSIV position indication? (0.5)

End of category 2

QUESTION 3.01 (3.50)

a. Provide FIVE of the six conditions that are required in order for No. 33 D/G output breaker to close and supply power to Bus 5A. (2.0)

b. Provide FOUR ESF loads that are (or may be) started on Bus 5A by the Bus 5A Sequence Signal, assuming a blackout with SI has occurred. (1.5)

QUESTION 3.02 (3.00)

a. In what positions of the Rod Cluster Control System (RCCS) Bank Selector Switch is "Bank Overlap" in service? (0.5)

b. At what BANK C POSITION should Bank ~~B~~ "C" rod begin to withdraw? (0.5)
TYPOGRAPHICAL ERROR

c. BRIEFLY EXPLAIN why the RCCS Startup Pushbutton is not used when recovering from a dropped control rod at power. (0.5)

d. Indicate the direction of rod motion (IN, OUT OR NONE) if the following instrument failures occur with RCCS in AUTOMATIC control at 50% power.

1) Loop 3 Tcold input to Tavg fails LOW.
2) Turbine impulse pressure fails LOW.
3) Power range channel N43 fails HIGH. (1.5)

QUESTION 3.03 (1.50)

The plant is operating at 50% power with all systems in automatic. How does a HIGH failure of Power Range channel N-44 LOWER detector affect the following indications? (Limit your answer to INCREASE, DECREASE, MORE NEGATIVE, LESS NEGATIVE, or NO CHANGE.)

a. Lower Quadrant Power Tilt Ratio (QPTR)

b. Delta Flux (Axial Flux) indication (Channel 4)

c. Overpower Delta T trip Setpoint (Channel 4) (1.5)

QUESTION 3.04 (3.50)

Provide the FIVE automatic Engineered Safeguards initiation signals. (Include all applicable setpoints and logic/coincidence.) (3.5)

QUESTION 3.05 (3.00)

a. In order for Automatic Makeup to occur to the VCT, what positions must the following CVCS component control switches be placed in?

1) Mode Selector Switch
2) Makeup Control Switch
3) ~~Auto-Manual Switch~~
4) BA Transfer Pump Switches (Speed)
5) BA Transfer Pump Control Switches
6) PW Pump Control Switches (1.8)

b. At what VCT level should Automatic Makeup...

1) Start?
2) Stop? (0.7)

c. True or False?

If the electrical (control) signal from the CR charging pump controller to the charging pump is lost, the pump speed will fail to MAXIMUM. (0.5)

QUESTION 3.06 (3.00)

a. What is the advantage of using the Feed Pump Speed Control (FPSC) System? (0.5)

b. Which FOUR parameters are used as inputs to the FPSC system? (2.0)

c. How does the FPSC provide cavitation protection for the boiler feedwater pumps? (0.5)

QUESTION 3.07 (3.00)

Briefly describe any AUTOMATIC actions that occur when the following Process Radiation Monitoring System channels reach their alarm setpoints.

a. Condenser Air Ejector Gas Monitor (R-15)

b. Component Cooling Water Monitor (R-17A)

c. Steam Generator Blowdown Monitor (R-19) (3.0)

QUESTION 3.08 (1.50)

Indicate which of the Excore Nuclear Instrumentation Ranges (SOURCE, INTERMEDIATE, or POWER), will correctly match with the following statements. (May be all, none or any combination of the ranges.)

a. Provides a direct input to the Rod Control System. (Not Rx Trips)

b. Has a reactor trip function that is blocked at some time between startup and full power operation.

c. Operates in the "Ion Chamber" region of the "Gas Filled Detector Characteristic Curve". (1.5)

QUESTION 3.09 (3.00)

The IP-3 Reactor Protection System (RPS) is designed so a turbine trip will cause a Reactor Trip above 10% power.

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

b. State TWO RPS trips that would act to give backup protection in the event that the Reactor Trip did not operate on a turbine trip from full power. (1.0)

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

d. How does the RPS circuitry prevent (inhibit) this trip from occurring at power levels less than 10%? (0.5)

End of category 3

QUESTION 4.01 (2.50)

Answer the following by in accordance with information found in ONOP-RCS-6 (Natural Circulation/Natural Circulation Cooldown).

a. Which temperature instruments are to be used during Natural Circulation (NC) conditions? (0.6)

b. BRIEFLY EXPLAIN why these instruments are preferred during NC. (0.4)

c. Provide THREE conditions that you would observe to confirm the effectiveness of the NC heat removal process. (1.5)

QUESTION 4.02 (3.00)

List SIX of the seven actions that you are directed to take to insert rods if an automatic reactor trip is required by RPS but does not occur (ATWS). (3.0)

QUESTION 4.03 (2.50)

Answer the following in accordance with information found in PEP-ES-1 (ECCS Actuation).

a. Under which TWO situations would pressurizer water level NOT be a valid indication of primary system inventory? (1.0)

b. What is the Reactor Coolant Pump stoppage criteria during a LOCA? (1.5)

QUESTION 4.04 (3.00)

Answer the following in accordance with information found in PEP-CVCS-3 (Emergency Boration).

a. Provide THREE of the four conditions that require emergency boration to be initiated. (1.5)

b. What are the THREE steps you must normally perform to initiate emergency boration flow. (1.5)

QUESTION 4.05 (3.00)

Answer the following concerning information found in POP-1.2 (Reactor Startup).

a. What are the MINIMUM requirements for Source and Intermediate range operability (# required) prior to startup?

b. What is the MINIMUM temperature for criticality?

c. What is the MAXIMUM startup rate permitted under normal conditions?

d. What is the MINIMUM source range count rate required for a startup utilizing control rods? (3.0)

QUESTION 4.06 (3.00)

The RCS is in a solid condition with temperature and pressure at 100 F and 300 psig. The RHR system is operating with one pump and is letting down to the CVCS. One charging pump is operating. The "VALVE 730 OR 731 NOT FULLY OPEN" annunciator is received.

a. What immediate operator actions are required? (2.4)

b. Approximately how long after the alarm receipt will the valves be fully closed. (0.6)

QUESTION 4.07 (3.00)

a. Provide FIVE conditions or indications that require immediate shutdown of a Reactor Coolant Pump. (Non-LOCA conditions.) (2.5)

b. Why are limitations placed on the operation of the #1 Seal Bypass Valve? (0.5)

QUESTION 4.08 (3.00)

Answer the following in accordance with information located in the IP-3 Technical Specifications.

a. Define HOT SHUTDOWN. (1.0)

b. Which THREE parameters must you observe in order to verify that Reactor Core Safety Limits are being adhered to? (1.5)

c. Provide the following temperature limitation values.

1) Pressurizer heatup rate.
2) Pressurizer cooldown rate. (0.5)

QUESTION 4.09 (2.00)

A leak has developed in a CVCS Letdown piping component located outside the containment building that may be manually isolated by maintenance personnel. The general area radiation level in the area where the leak is to be isolated is 600 millirem per hour. The one available person to perform the work informs you that his present quarterly exposure and lifetime exposure levels are 2.90 Rem and 54.75 Rem respectively.

a. Using only 10 CFR 20 whole body exposure limits as a guide, how long may this man work in the area before he exceeds his quarterly exposure limit? (SHOW YOUR WORK) (1.5)

b. What is the minimum age that this man may be to perform the work? (SHOW YOUR WORK) (0.5)

End of category 4

EQUATION SHEET

$f = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

$\dot{Q} = \dot{m} C_p \Delta t$

$\dot{Q} = UA\Delta T$

$Pwr = W_f \Delta h$

$P = P_o 10^{sur(t)}$

$P = P_o e^{t/T}$

$SUR = 26.06/T$

$SUR = 26\rho/\ell^* + (\beta - \rho)T$

$T = (\ell^*/\rho) + [(\beta - \rho)/\bar{\lambda}\rho]$

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff}-1))/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [(\ell^*/(T K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$P = (\Sigma\phi V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$v = s/t$

$s = V_o t + 1/2\ at^2$

$a = (V_f - V_o)/t$

$w = \theta/t$

$A = \frac{\pi D^2}{4}$

$\dot{m} = V_{av} A \rho$

Cycle efficiency = (Net work out)/(Energy in)

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

$\lambda = \ln 2/t_{1/2} = 0.693/t_{1/2}$

$t_{1/2}^{eff} = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$I = I_o e^{-\Sigma x}$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^{\ 2} = I_2 d_2^{\ 2}$

$R/hr = (0.5\ CE)/d^2$ (meters)

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

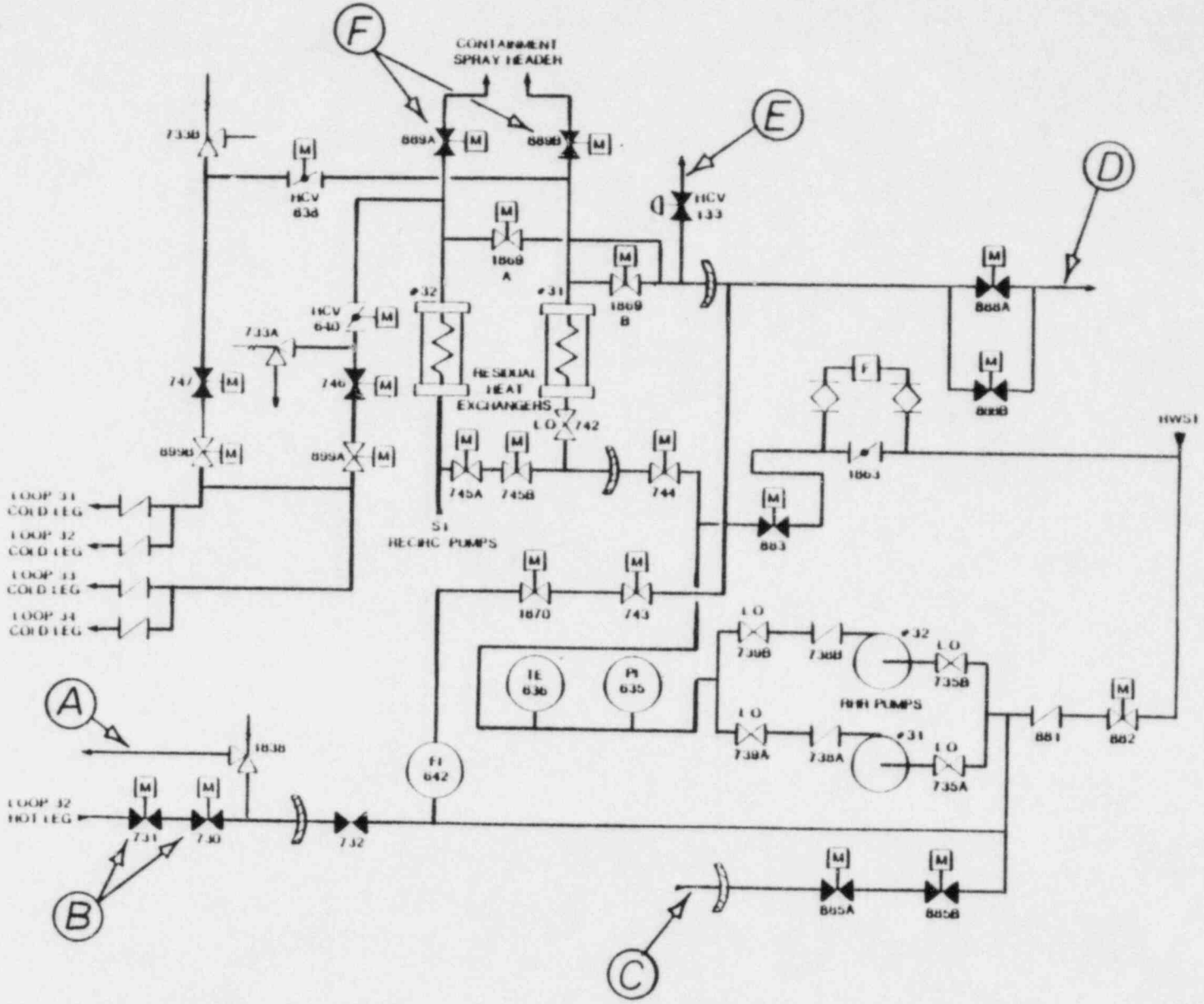
1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

RESIDUAL HEAT REMOVAL SYSTEM

FIGURE 2-1



NAME _____

FIGURE 2-2

(Please include this sheet with your ANSWER sheets.)

MASTER COPY

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 1.01 (3.00)

a. LESS NEGATIVE [0.25] More boron to leave core area per degree temperature change. (Or equivalent answer) (1.0)

b. MORE NEGATIVE [0.25] Less boron for opposite result as above. (1.0)

c. LESS NEGATIVE [0.25] Water density changes are ~~greater~~ less as temperature is reduced. (1.0)

REFERENCE
IP-3 ECI Rx Theory; Chapter 5, Pages 21 through 27

ANSWER 1.02 (2.50)

a. - The amount of Xe produced from fission/decay is greater. (0.75)
- The absorption cross section for Xe is much higher. (0.75)

b. 1) ~~2840~~ 2700 ± 100 pcm
2) ~~1940~~ 2000 ± 100 pcm (~~4780~~ 4700 ± 200 total pcm) (CAF) [0.5 each] (1.0)

REFERENCE
IP-3 Graph Book, Section 1, Pages 3 and 4
IP-3 ECI Rx Theory

ANSWER 1.03 (1.50)

NO [0.5] EITHER: Only nececessary for source range indication (or verification of instrument operation) while performing a reactor startup. [1.0]

Many other sources of neutrons available for this purpose (cosmic, intrinsic, decay, etc.) [1.0] (1.5)

REFERENCE
IP-3 ECI Rx Theory; Chapter 4, Pages 44 through 48

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 1.04 (2.50)

a. M: The ratio of the total number of fission and source neutrons to the total number of neutrons which would exist due to the source only. (1.0)

b. 1) Fuel loading/Refueling
2) Rod Withdrawl Startup
3) Boron Dilutions (Startup) [0.5 each], 3 required] (1.5)
4) ECP Discrepancy

REFERENCE
IP-3 ECI Rx Theory, Chapter 4, Pages 53 and 67
IP-3 POP 1.2, page 8

ANSWER 1.05 (1.50)

a. (2) Core axial flux profile. (0.5)

b. The curve is more linear (due to the additive effect of the rod worths at their low values.) (1.0)

REFERENCE
IP-3 ECI Rx Theory; Chapter 7, Pages 21, 22, and 27

ANSWER 1.06 (3.00)

a. SAME [0.25] Steam dumps will compensate for any additional heat added by the fourth RCP. RCS temperature/reactivity unchanged. [0.5] (0.75)

b. ECP LOWER than ACP [0.25] Xenon will increase to near peak at 8 hours after trip. Rods must be higher to compensate. [0.5] (0.75)

c. ECP LOWER than ACP [0.25] The corresponding temperature increase must be compensated by a higher critical rod position. [0.5] (0.75)

d. ECP HIGHER than ACP [0.25] The reduction in temperature must be compensated by a lower rod position. [0.5] (0.75)
(Higher/Lower answer may vary with proper supporting explanation, ie, "Higher than ECP".)

REFERENCE
IP-3 Graphs Book, Section 1, Pages 4 and 8

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 1.07 (3.00)

a. - Low temperature
- Vessel stress
- Pre-existing material flaw [0.5 each] (1.5)

b. (RT NDT) is the temperature at which non-ductile failure will no longer occur. (Or equivalent answer) (0.5)

c. Increases [0.5] because of metal changes due to (fast) neutron irradiation [0.5]. (1.0)

REFERENCE
IP-3 TS, Pages 3.1-4 through 7
WNTC Thermodynamics 13-58 through 13-68

ANSWER 1.08 (1.50)

a. True

b. False

c. False [0.5 each] (1.5)

REFERENCE
IP-3 Thermodynamics, Chapter 6, Pages 27 and 29

ANSWER 1.09 (2.00)

a. Decrease pump flow rate (speed)

b. Increase VCT level

c. Increase VCT pressure

d. Decrease VCT outlet temperature (letdown HX outlet) [0.5 each] (2.0)

REFERENCE
IP-3 SD, CVCS, Page 16
IP-3 Thermodynamics, Chapter 6, Pages 39 and 40

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 1.10 (3.00)

a. Rod groups sequenced and overlapped.
b. Rod insertion limits adhered to.
c. Axial flux difference limits adhered to.
d. Rod group alignment maintained. [1.0 each; 3 required] (3.0)

REFERENCE
IP-3 TS, pages 3.10-10 and 11

ANSWER 1.11 (1.50)

Q = m c Delta T = m Delta h (or equivalent) [0.5]

If the hot leg reaches saturation, the latent heat of vaporization would not be accounted for and reactor power could increase with no corresponding increase in core Delta T. [1.0] (1.5)

REFERENCE
ECI Thermodynamics, Chapter 1, pages 29 and 30
Chapter 2, pages 29 through 33
Chapter 9, page 29

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 2.01 (3.00)

a. - Thermal Barrier CCW Header Lo Flow
- RCP Thermal Barrier Cooling Return Hi Temp
- Process Monitor Hi Radiation (and respective indicating light)
- Component Cooling Surge Tank No. 31/32 Level
- (CAF) [any 3 @ 0.5 each] (1.5)

b. - Return high flow closes return isolation valve (~~701~~ FCV-625)
- Check valve (774) isolates on reverse flow
- Relief valve (783) protects isolated piping [0.5 each] (1.5)
(2485) (to contmt. sump)

REFERENCE
IP-3 SD CCW, Pages 3, 4 and 20
PID 9321-F-27203-13

ANSWER 2.02 (2.50)

a. 1) 31 INTERMEDIATE
2) 31 COLD
3) 31 COLD
4) 32 HOT [0.375 EACH] [0.2 for loop; 0.175 for location] (1.5)

b. - RCP seal return (218)
- CVCS letdown (203)
- SI test line (855)
- RHR injection header 1 } (733A&B)
- RHR injection header 2 }
- RHR hot leg suction [any 5 @ 0.2 each] (1.0)
[additional incorrect @ 0.1 each]
(1836)

REFERENCE
IP-3 SD RCS; Page 7
IP-3 SD Pzr/PRT; Page 19
Dwg. 9321-F-27353-14

ANSWER 2.03 (3.00)

a. RCS Oxygen: Hydrogen
pH: Lithium Hydroxide

S/G Oxygen: Hydrazine
pH: Ammonium Hydroxide [0.5 each] (2.0)

b. TRUE (0.5)

c. FALSE (0.5)

REFERENCE
IP-3 SD Plant Chemistry; Pages 3, 4, and 23

ANSWER 2.04 (3.50)

a. PRT (0.375)

b. - Won't open if pressure above 450 psig [0.5]
- Closes if pressure above 550 psig [0.5]
- Cont. sump suctions (885A&B) and High Head SI supply valves (88A&B) cannot be opened if 730 and 731 are open [0.5] (1.5)
(If provided separately, 885A&B will be counted as 2 responses)

c. Containment sump (0.375)

d. ~~CVCS~~ (HHSI pumps) Safety Injection (0.375)

e. CVCS (letdown) (0.375)

f. Manual (0.5)

REFERENCE
IP-3 SD RHR; Chapter 4.2, Page 3 and Diagram

ANSWER 2.05 (2.50)

a. - Containment High Radioactivity (R-11 or R-12)
- High-high Containment Pressure (CSAS)
- ESF (SI)
- Manual Containment Spray
- Manual [0.5 each, 4 required] (2.0)
- Vapor Containment High Iodine (R-29 or Ch. 2)

b. TRUE (0.5)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
IP-3 SD Cont. Isol., Page 13 and 22
IP-3 SD Cont. Spray, Pages 3 and 4
IP-3 Ventillation and Containment Logic prints

ANSWER 2.06 (2.50)

a. - Removes exhaust gases/supplies intake air [0.5]
   - Increases the density of the intake air [0.5] (1.0)

b. Increases output capacity of diesel/generator. (0.5)

c. - speed setting (description of switch functions are acceptable)
   - speed droop
   - load limit [0.33 each] (1.0)

REFERENCE
IP-3 SD Emer. D/G; Pages 15, 16 and 18

ANSWER 2.07 (3.50)

a. - High-high containment pressure [0.4]
   - Both manual pushbuttons simultaneously depressed [0.6] (1.0)

b. - Spray pump discharge valves (866A-B) open [0.4]
   - Both Spray pumps start [0.4]
   - Additive tank discharge valves (876A-B) open [0.4] after a 2 minute time delay [0.3] (if cancel button not depressed) (1.5)

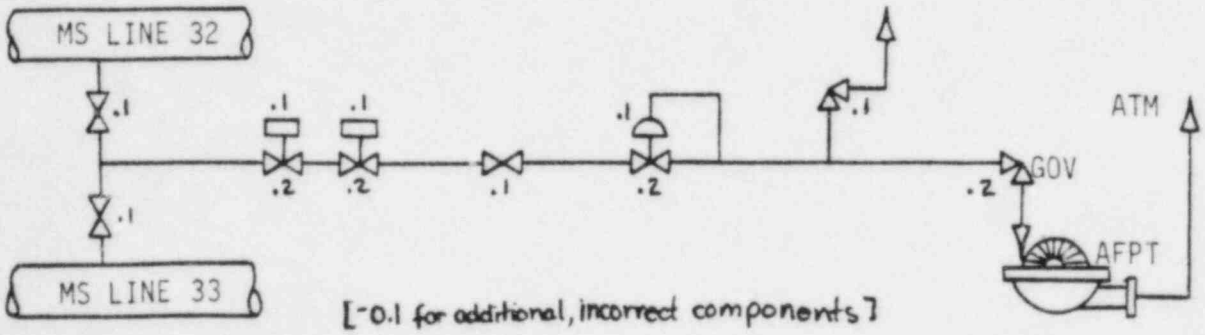
c. NaOH (0.5)

d. Minimize Iodine release (by maintaining it in solution) (0.5)

REFERENCE
IP-3 SD Cont. Spray, Pages 6, 13 and 14

ANSWER 2.08 (2.50)

a.



[-0.1 for additional, incorrect components]

(1.5)

b. - Low-Low Level in 2 S/Gs. [0.5]
- Loss of normal power to (3A or 6A) 480 buses [0.5] (1.0)

REFERENCE
IP-3 SD Main/Reheat Steam Figure 18-11
IP-3 SD Feedwater, Page 34

ANSWER 2.09 (2.00)

a. 1) Air [0.5]
2) Spring and Steam [1.0] (1.5)

b. Turbine trip (0.5)

REFERENCE
IP-3 SD Main and Reheat Steam, Pages 8 and 9

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 3.01 (3.50)

a. - No D/G fault
- D/G voltage satisfactory
- No Bus 5A fault
- Loss of outside power confirmed (52/5A breaker open)
- Bus 5A undervoltage condition
- Bus tie breaker (2AT5A) open [any 5 @ 0.4 each] (2.0)

b. - SI pump 31
- Cont. Spray pump 31
- Service Water pump 34
- Cont. Recirc fan 31
- Cont. Recirc fan 33
- CCW pump 31 [any 4 @ 0.375 each][load number @ .075 pts] (1.5)
- Service water pump 31

REFERENCE
IP-3 SD ESF, Pages 18 and 21

ANSWER 3.02 (3.00)

a. - AUTOMATIC
- MANUAL [0.25 each] (0.5)

b. 128 steps (0.5)

c. The pushbutton will rezero all rods (only the affected group rods require reset). (0.5)

d. 1) NONE
2) IN
3) IN (CAF) [0.25 each] (1.5)

REFERENCE
IP-3 SD RCCS, Pages 20 and 63 through 70

ANSWER 3.03 (1.50)

a. INCREASE

b. MORE NEGATIVE

c. DECREASE (CAF) [0.5 each] (1.5)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
IP-3 SD Excore Instr., Figure 13-17
IP-3 SD Unit Protection, Page 10

ANSWER 3.04 (3.50)

- High Steamline Flow [0.4], (Variable), 1/2 in 2/4 S/G [0.1]
  - Low Tavg [0.1], 540F [0.1], 2/4 [0.1] (542°F)
  - Low S/G Pressure [0.1], 600 psig [0.1], 2/4 [0.1] (616 psig)

- Steamline Differential Pressure [0.4], 150 psid [0.1], 2/3 in 1/3 SL [0.1] (125 psid)

- Low Pressurizer Pressure [0.4], 1700 psig [0.1], 2/3 [0.1] (1720 psig)

- High Containment Pressure [0.4], 2.0 psig [0.1], 2/3 [0.1] (3.0 psig)

- High-High Containment Pressure [0.4], 23 psig [0.1], 2/3 [0.1] (22 psig) (3.5)
  ~~(CAF)~~ (Setpoint values in addition to T.S. are also acceptable) (in 2/2 trns.)

REFERENCE
IP-3 SD ESF, Page 9
IP-3 SD Unit Prot, Fig. 28-14, Page 77, and TS attachment
IP-3 PEP-ES-1, page 2

ANSWER 3.05 (3.00)

a. 1) Auto[.4]
   2) Neutral (After manual return from start.) [0.4]
   ~~3) Auto~~
   4) Slow [0.4]
   5) Auto [0.3]
   6) Auto [0.3] ~~[0.3 each]~~ (1.8)
   ("Auto" answer for either 1 or 3 will be given full credit for 1)

b. 1) 22%
   2) 29% [0.35 each] (0.7)

c. FALSE (0.5)

REFERENCE
IP-3 SD CVCS, Pages 19, 20 and 26
IP-3 Control Board Observation

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 3.06 (3.00)

a. Provides a D/P program to obtain a linear feed flow response for FRV operating at mid position (This prevents excessive FRV throttling.) (0.5)

b. - FP suction (header) pressure
- FP discharge (header) pressure
- Mn. steam (header) pressure
- S/G steam flow [0.5 each] (2.0)

c. Runs back the pump speed for reduced suction pressures (315 psig to 280 psig) (0.5)

REFERENCE
IP-3 SD SGWLC; Pages 2 and 12

ANSWER 3.07 (3.00)

a. - A.E. exhaust is shifted to containment
- Steam to Cond. Priming Ejectors (PCV-1133) isolated *(Hoggers)
- Flash Evaporator is shutdown [0.4 each] (1.2)

b. CCW surge tank vent valve (RCV-017A) isolates (Presently ~~tagged~~ shut) (0.6)

c. - Blowdown lines isolate (PCV-12141A -> PCV-1217/A)
- Sample lines isolate (PCV-1223/A -> PCV-1226/A)
- Spraywater to blowdown tank (PCV-1227) isolates [0.4 each] (1.2)

REFERENCE
IP-3 SD Rad. Monitoring and Prot., Pages 31 and 32

ANSWER 3.08 (1.50)

a. INTERMEDIATE, POWER

b. SOURCE, INTERMEDIATE, POWER

c. INTERMEDIATE, POWER [0.5 each] (1.5)

REFERENCE
IP-3 SD Excore Instr., Figure 13-36

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 3.09 (3.00)

a. Minimizes the thermal (pressure) transient after a trip. (1.0)

b. - OT Delta T - Pzr High Level
- High Pressure - S/G Low Level (All trips from full power give S/G Low level)
- ~~1CAF~~ [any 2 @ 0.5 each] (1.0)

c. Autostop oil pressure low (45 psig) (0.5)

d. The turbine trip signal is needed in coincidence with P-7. (P-7 not present < 10%) (0.5)

REFERENCE
IP-3 SD Unit Prot., Pages 21 and 22
IP-3 FSAR

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 4.01 (2.50)

a. - Pressurizer temperature [0.1]
   - Loop (WR) temperatures [0.3]
   - Core exit thermocouples ~~[all required @ 0.2 each]~~ [0.2] (0.6)

b. No manifold flow exists for NR RTDs. (0.4)

c. - S/G steam release with constant steam pressure.
   - Core exit TCs below saturation temperature for existing RCS pressure and constant or decreasing.
   - Cold leg temperatures near saturation for S/G pressure.
   - Hot leg temperatures constant or decreasing (approximately the same as TCs).
   - Loop Delta T not more than full power Delta T. [any 3 @ 0.5 ea] (1.5)

REFERENCE
ONOP-RCS-6, pages 2 and 4

ANSWER 4.02 (3.00)

- Depress the manual trip pushbuttons.
- Depress test cabinet pushbuttons.
- Open DC Distribution Panel circuits (P31-7 and P32-8).
- Open the reactor trip breakers locally.
- Open the MG set generator breakers locally.
- De-energize the MG sets locally (at the 480 volt switchgear).
- De-energize the 480 volt busses 2A and 6A. [any 6 @ 0.5 each] (3.0)

REFERENCE
PEP-RPC-1, page 2

ANSWER 4.03 (2.50)

a. - A leak/LOCA is in the pressurizer vapor space.
   - A bubble exists in the reactor vessel area. [0.5 each] (2 required) (1.0)
   - Adverse containment conditions present

b. - IF RCS pressure drops uncontrollably to 1196 psig [0.75]
   - Verify SI pump operation [0.75]
   - (THEN stop all RCPs) (1.5)

REFERENCE
PEP-ES-1, pages 1 and 6 and ES-1C, page 1

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 4.04 (3.00)

a. - Two or more rods fail to insert after reactor trip.
- Uncontrolled cooldown below 540 F if one rod stuck out following a reactor trip.
- Uncontrolled cooldown below 500 F following a reactor trip.
- Control bank position below below the insertion limit. [any 3 @ 0.5 each] (1.5)

b. - Open Emergency Boration Valve (MOV-333) [0.5]
- Place operating BAT pump in fast speed. [0.5]
- Increase charging pump speed to maximum. [0.5] (1.5)

REFERENCE
PEP-CVCS-3, pages 1 and 2

ANSWER 4.05 (3.00)

a. 1 each range

b. 450 F

c. 1 dpm

d. 2 cps [0.75 each] (3.0)

REFERENCE
PDP-1.2, pages 1 and 2

ANSWER 4.06 (3.00)

a. .5 - Adjust LD Pressure Control (PC-135) (to maintain 50 psig.)
.5 - Secure charging pump.
.5 - Secure RHR pumps.
.2 - Place EXLD in service.
.5 - Ensure PORVs properly operate.
.2 - Open 730/731 as soon as they close. [0.4 each, all required] (2.4)

b. 3 1/2 minutes (3-4 accepted) (2-5 for half credit) (0.6)

REFERENCE
PDP-3.4, page 3

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 4.07 (3.00)

a. - Stator temperature reaches 250 F.
- Upper/lower motor bearing temperature >200 F.
- High/low oil level alarms in motor bearing reservoirs accompanied by other abnormal pump indications.
- #1 seal return flow 0.3 gpm or less.
- Indicated D/P accross the #1 seal <325 psid.
- Seal injection water temperature reaches 170 F.
- Vibration at the top of the motor stand 5 mils or more.
- Shaft vibration 20 mils or more.
- Rapid increase of seal return flow to > 5 gpm.
~~(CAF)~~ [5 required @ 0.5 each] (2.5)

b. Prevents #1 seal (runner) from jamming. (0.5)

REFERENCE
IP-3 SD RCP, pages 27 and 28
SOP-RCS-1, (Not Provided)

ANSWER 4.08 (3.00)

a. - Rx subcritical with adequate SDM (IAW Figure 3.10-1) [0.5]
- Tavg >200 F but less than or equal to 555 F. [0.5] (1.0)

b. - Rx (thermal) power
- RCS pressure
- RCS temperature [0.5 each] (1.5)

c. 1) 100 F/Hr
2) 200 F/Hr [0.25 each] (0.5)

REFERENCE
IP-3 TS, Pages 1-1, 2.1-1 and 3.1-4

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 4.09 (2.00)

a. 3000 - 2900 mRem = 100 mRem dose remaining [0.5]

600 mR/Hr X 1 Hr/60 minutes = 10 mRem per minute [0.5]

100 mR/10 mR/minute = 10 minutes [0.5] (1.5)

b. 5(N-18) = 54.75 + 0.10 [0.3]

N - 18 = 54.85/5

N - 18 = 11

N = 11 + 18 = 29 [0.2] (0.5)

REFERENCE
ECI Health Physics, Chapter 6, page 5

Attachment 1
SRO Exam

MASTER COPY

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

FACILITY: INDIAN POINT 3

REACTOR TYPE: PWR-WEC4

DATE ADMINISTERED: 85/04/23

EXAMINER: SAILOR, B.

APPLICANT: _____

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 (3.00)

Indicate whether the value of the following reactivity parameters will become MORE NEGATIVE, LESS NEGATIVE, or REMAIN THE SAME (no significant change) for their respective condition changes below. BRIEFLY EXPLAIN your answer.

a. MTC (pcm/degree F): Beginning of cycle (BOL) to end of cycle (EOL).

b. Doppler only power coefficient (pcm/% power): 1% to 100% power.

c. Total power defect (pcm): BOL to EOL (3.0)

QUESTION 5.02 (2.50)

a. Define Subcritical Multiplication (M). (0.75)

b. Briefly explain why M is not used to plot a criticality prediction. (0.75)

c. If the count rate is 100 cps at a Keff of 0.95, what will the count rate be at a Keff of 0.99? (1.0)

QUESTION 5.03 (2.00)

a. Which parameter below will have the MOST effect on the shape of a Differential Rod Worth Curve? BRIEFLY EXPLAIN your answer.

1) Core radial flux profile
2) Core axial flux profile
3) Core axial temperature profile
4) Time of core cycle (2.0)

QUESTION 5.04 (2.00)

a. Does Beta bar effective INCREASE, DECREASE, or REMAIN THE SAME from BOL to EOL? EXPLAIN YOUR CHOICE. (1.5)

b. For two equivalent positive reactivity additions to a critical reactor, will the SUR be the SAME, LARGER, or SMALLER at EOL as compared to BOL? NO EXPLANATION IS NECESSARY. (0.5)

QUESTION 5.05 (2.00)

a. A variable speed centrifugal pump is operating at 1/4 rated speed in a CLOSED system with the following parameters:

Power = 300 KW
Pump Delta P = 50 psid
Flow = 880 gpm

What are the new values for these parameters when the pump speed is increased to full rated speed? (1.5)

b. Choose the answer that most correctly completes the sentence.

"In a CLOSED system, two single stage centrifugal pumps operating in parallel will have--(choose-form-below)--, as compared to the same system with one single stage centrifugal pump operating with one pump isolated."

1. a higher head and higher flow rate.

2. the same head and the same flow rate.

3. the same head and a higher flow rate.

4. a higher head and the same flow rate. (0.5)

QUESTION 5.06 (3.00)

Explain HOW and WHY the Doppler Power Coefficient is affected by the following:

a. Buildup of fission gasses in the fuel to clad gap. (1.0)

b. Fuel desification. (1.0)

c. Clad creep. (1.0)

QUESTION 5.07 (2.50)

Assume that compliance with a Technical Specification action statement has limited reactor power to 75%. In an attempt to obtain the maximum megawatts from the main generator, steam to the high pressure feed heaters is secured.

a. Will this action provide a continuous increased generator megawatt output? (0.5)

b. Briefly explain your answer. (2.0)

QUESTION 5.08 (2.00)

What is the most significant type of heat transfer (conduction, convection or radiation) taking place under each of the following conditions? Consider each condition separately.

a. Nucleate boiling.

b. Accident condition in which coolant is boiled and converted to steam in the reactor core area.

c. Heat from fission through the fuel rod.

d. Decay heat removal by natural circulation. (2.0)

QUESTION 5.09 (3.00)

Hot channel factors are measurable and their Technical Specification surveillance frequency requirements are relatively low provided FOUR items are monitored and verified to be within their limits. What are these FOUR items? (3.0)

QUESTION 5.10 (3.00)

Compare the CALCULATED Estimated Critical Position (ECP) for a startup to be performed 4 hours after a trip from 100% power, to the ACTUAL critical control rod position if the following events/conditions occurred. Consider each independently. Indicate whether the ECP is HIGHER than, LOWER than, or the SAME as the actual critical control rod position AND BRIEFLY EXPLAIN the reason for your answer.

a. The FOURTH coolant pump is started two minutes prior to criticality. (0.75)

b. The startup is delayed until 8 hours after the trip. (0.75)

c. The steam dump pressure setpoint is increased to a value just below the Steam Generator Atmospheric Dump (PORV) setpoint. (0.75)

d. All Steam Generator levels are rapidly being raised by 5% as criticality is reached. (0.75)

End of category 5

QUESTION 6.01 (2.00)

Indicate if the following statements are TRUE or FALSE concerning use of Hydrogen in the RCS.

a. Hydrogen becomes flammable when concentrations exceed 4% in air. (0.4)

b. Use of hydrogen will minimize the formation of oxygen in the RCS. (0.4)

c. The majority of oxygen scavenging by hydrogen occurs in the VCT. (0.4)

d. Hydrogen concentration is normally maintained 25 and 50 cc/Kg when at power. (0.4)

e. A disadvantage of adding hydrogen is that it is a significant contributor to the total tritium produced in the RCS. (0.4)

QUESTION 6.02 (3.00)

a. Provide four component cooling (CCS) system alarms that could indicate a RCS to CCW leak. (1.5)

b. Describe, in detail, how the CCW system is protected against an overpressure condition if a RCS to CCW rupture occurred in the RCS Thermal Barrier. (1.5)

QUESTION 6.03 (2.50)

a. Provide the five signals that will initiate Containment Ventilation Isolation. (~~No~~ setpoints required.) (2.0)

Discuss Interlocks and ↑

b. TRUE or FALSE?

BOTH containment spray trains OR ALL (5) containment FCUs OR ONE spray train and THREE FCUs are all possible combinations that will maintain containment conditions below their design limits during the injection phase of a LOCA. Make a choice and discuss (0.5)

QUESTION 6.04 (3.50)

a. Provide FIVE of the six conditions that are required in order for No. 33 D/G output breaker to close and supply power to Bus 5A. (2.0)

b. Provide the SIX ESF loads that are (or may be) started on Bus 5A by the Bus 5A sequence Signal, assuming a Blackout with SI has occurred. (1.5)

QUESTION 6.05 (3.00)

The plant is operating at 50% power with all systems in automatic. Briefly explain how a HIGH failure of Power Range channel N-44 LOWER detector affects the following indications?

a. Lower Quadrant Power Tilt Ratio (QPTR)

b. Delta Flux (Axial Flux) indication (Channel 4)

c. Overpower Delta T trip setpoint (Channel 4) (3.0)

QUESTION 6.06 (3.50)

a. In what positions of the Rod Cluster Control System (RCCS) Bank Selector Switch is "Bank Overlap" in service? (0.5)

b. List the THREE reasons (bases) for Rod Insertion Limits (RIL). (1.5)

c. Indicate the direction of rod motion (IN, OUT or NONE) if the following instrument failures occur with RCCS in AUTOMATIC control at 50% power.

1) Loop 3 Tcold input to Tavg fails LOW.
2) Turbine impulse pressure fails LOW
3) Power range channel N43 fails HIGH (1.5)

QUESTION 6.07 (2.50)

a. What is the design purpose of the Overpressure Protection System (OPS)? (0.5)

b. Briefly describe the sequence of events that would occur during an uncontrolled plant cooldown to actuate the OPS. (Include applicable setpoints.) (1.5)

c. At what increasing temperature will OPS be automatically blocked? (0.5)

QUESTION 6.08 (3.00)

a. What is the purpose of the following steam dump interlocks?

1) Condenser Vacuum
2) Loss of Load (1.0)

b. What signal parameters input to the Condenser Vacuum interlock ? (1.0)

c. Provide the TWO conditions required to initiate Low Pressure Bypass Dump System operation. (No setpoints or logic required.) (1.0)

QUESTION 6.09 (2.00)

a. Which FOUR parameters are used as inputs to the FPSC system? (1.5)

b. How does the FPSC system provide cavitation protection for the boiler feedwater pumps? (0.5)

End of category 6

QUESTION 7.01 (3.50)

Answer the following in accordance with information found in PEP-CVCS-3 (Emergency Boration).

a. Provide the FOUR conditions that require emergency boration to be initiated. (2.0)

b. What are the THREE steps that must be performed to initiate Emergency Boration flow. (1.5)

QUESTION 7.02 (3.50)

Answer the following in accordance with information found in PEP-ES-1 (ECCS Actuation).

a. If during LOCA conditions, a Containment High-High Pressure Signal is generated, what additional automatic actions must be verified? (1.5)

b. If after the ECCS actuation , RCS pressure drops in an uncontrolled manner to 1196 psig, what actions are required to be performed? (1.0)

c. Under which TWO conditions would pressurizer water level NOT be a valid indication of primary system inventory? (1.0)

QUESTION 7.03 (4.00)

a. List the SEVEN actions that are required to be taken to insert the rods if an automatic reactor trip is required by RPS but does not occur (ATWS). (2.8)

b. If a turbine trip is not verified, what THREE action steps are required to be taken? (1.2)

QUESTION 7.04 (3.00)

Answer the following in accordance with information found in ONOP-RCS-5 (Natural Circulation/Natural Circulation Cooldown).

a. Which temperature instruments are to be used during Natural Circulation (NC) conditions? (0.6)

b. BRIEFLY EXPLAIN why these instruments are preferred during NC. (0.4)

c. Provide FOUR conditions that you would observe to confirm the effectiveness of the NC heat removal process. (2.0)

QUESTION 7.05 (2.50)

According to ONOP-RCS-2 (Malfunction of Pressurizer Control System), What FOUR actions (verifications) are directed to be taken if pressurizer pressure is DECREASING below the control/alarm setpoint and a reactor trip has not yet occurred? Contingency actions (response not obtained) are NOT required for these four actions. (2.5)

QUESTION 7.06 (2.50)

BRIEFLY EXPLAIN the reasons for the following Precautions and Limitations found in POP-1.1 (Plant Heatup from Cold Shutdown Condition).

a. The shutdown banks must be at the fully withdrawn position whenever positive reactivity is being added by boron and xenon changes, reactor coolant temperature change, or motion of part length rods or control banks other than the shutdown banks. (0.75)

b. If the count rate of either source range channel increases by a factor of two or more during any step involving boron concentration change, the operation must be stopped immediately and suspended until a satisfactory evaluation has been made by the Shift Supervisor. (0.75)

c. Hydrazine should not be added unless the volume control tank gas blanket contains less than 2.0% oxygen. (0.5)

d. If hydrazine is added to scavenge oxygen during heatup, the demineralizers should be bypassed. (0.5)

QUESTION 7.07 (3.00)

Answer the following concerning information found in POP-1.2 (Reactor Startup).

a. What are the MINIMUM requirements for Source and Intermediate range operability (# required) prior to startup? (0.5)

b. What is the MINIMUM temperature for criticality? (0.5)

c. What is the MAXIMUM startup rate permitted under normal conditions? (0.5)

d. What is the MINIMUM source range count rate required for a startup utilizing control rods? (0.5)

e. BRIEFLY DESCRIBE the action required if it appears that criticality will be achieved greater than 100 steps below the ECP but less than the allowed rod insertion limit? (1.0)

QUESTION 7.08 (3.00)

The RCS is in a solid condition with temperature and pressure at 100 F and 300 psig. The RHR system is operating with one pump and is letting down to the CVCS. One charging pump is operating. The "VALVE 730 OR 731 NOT FULLY OPEN" annunciator is received.

a. What immediate operator actions are required? (2.4)

b. Approximately how long after the alarm receipt will the valves be fully closed. (0.6)

End of category 7

QUESTION 8.01 (1.00)

What is the required Technical Specification action if the Diesel Generator Building Water Sprinkler System is determined inoperable? (1.0)

QUESTION 8.02 (2.50)

Supply numerical values to complete the following limitations concerning Refueling Fuel Handling and Storage conditions as set forth by IP-3 Technical Specifications.

a. During reactor vessel head removal and while loading and unloading fuel in the reactor, Tavg shall be _<_____F and the minimum boron concentration sufficient to maintain the reactor subcritical by at least _____% Delta k/k. (1.0)

b. During periods of spent fuel cask or fuel storage building cask crane movement over the spent fuel pit, or during periods of spent fuel movement in the spent fuel pit, when the pit contains irradiated fuel, the pit shall be filled with borated water at a concentration of _>_____ppm. (0.5)

c. What immediate action is required if refueling is in progress and conditions in "a" above are not met? (1.0)

QUESTION 8.03 (2.00)

a. What action must be taken if the RCS Specific Activity exceeds 1.0 uCi/cc, Dose Equivalent I-131 and also exceeds the limit of the Technical Specification activity Figure 3.1-3? (1.0)

b. What is the TS basis for the ACTION required for a high RCS Specific Activity as described above? (1.0)

QUESTION 8.04 (1.50)

According to Indian Point 3 Technical Specifications:

a. The RCS heatup rate averaged over one hour shall not exceed _____F per hour. (0.5)

b. The Pressurizer cooldown rate, averaged over one hour shall not exceed _____F per hour. (0.5)

c. The maximum allowable temperature difference between the pressure pressure and spray fluid shall not exceed _____F. (0.5)

QUESTION 8.05 (3.00)

What are the FOUR "Minimum Conditions for Criticality" imposed by IP-3 Technical Specifications? (3.0)

QUESTION 8.06 (3.00)

Temporary changes may be made to plant procedures governed by Technical Specifications if three criteria are met. Provide these THREE criteria/conditions. (3.0)

QUESTION 8.07 (3.50)

Answer the following in accordance with information in the IP-3 Technical Specifications.

a. Define "High Radiation Area". (1.0)

b. Any individual permitted to enter a High Radiation Area shall be provided or accompanied by one of three methods of radiation monitoring. Describe, in detail, any ONE of these methods. (1.5)

c. List the additional requirements for the physical control of an area in which radiation levels exceed those of a "High Radiation Area". (1.0)

QUESTION 8.08 (3.50)

Answer the following utilizing information found in AP-11, Radioactive Effluents Control Program.

a. What is the minimum circulator flow required for all liquid radioactive releases? (0.25)

b. Who (by title) may authorize a liquid release at less than the minimum circulator flow? (0.25)

c. What are the minimum conditions required of the following parameters to permit a continuous S/G Blowdown release? If an option is permitted, either option is acceptable.

1) Radiation Monitoring
2) Flow Monitoring Equipment
3) Dilution Flow (1.5)

d. Describe what additional requirements are imposed if a liquid waste tank release is to be performed with R-18 inoperable. (1.5)

QUESTION 8.09 (2.50)

The following questions pertain to AP-13, Jumper Control Procedure.

a. From the conditions below, choose the ONE that would NOT be considered use of a jumper, by procedure. (0.5)

1. Lifting an installed wire
2. Use of an installed bypass switch
3. Gagging of a safety valve
4. Removing fuses from a trip circuit
5. Changing a setpoint to a value where it becomes ineffective.

b. What type of tag is required to be attached to a jumper? (0.5)

c. 1. Who must authorize a jumper if it is to be installed to defeat a trip or nuclear safety circuit in a non-emergency situation. (1.0)

2. Who must authorize a jumper if it is specified in an approved procedure? (0.5)

QUESTION 8.10 (2.50)

The following pertain to SOP-CB-2, Containment Entry and Egress.

a. Who (by title) must approve a containment entry inside the crane wall while at power? (0.5)

b. Provide THREE situations that require a containment entry group to leave the containment prior to job completion. (1.5)

c. What is the MAXIMUM size of the group allowed at power? (0.25)

d. What is the MINIMUM size of the group allowed at power? (0.25)

End of category 8

EQUATION SHEET

$f = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgn$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

$\dot{Q} = \dot{m} C_p \Delta t$

$\dot{Q} = UA\Delta T$

$Pwr = W_f \Delta h$

$P = P_o 10^{sur(t)}$

$P = P_o e^{t/T}$

$SUR = 26.06/T$

$SUR = 26\rho/\ell^* + (\beta - \rho)T$

$T = (\ell^*/\rho) + [(\beta - \rho)/\bar{\lambda}\rho]$

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [(\ell^*/(T\ K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$P = (\Sigma\phi V)/(3 \times 10^{10})$

$\Sigma = \sigma N$

$v = s/t$

$s = V_o t + 1/2\ at^2$

$a = (V_f - V_o)/t$

$w = \theta/t$

$A = \frac{\pi D^2}{4}$

$\dot{m} = V_{av} A \rho$

Cycle efficiency = (Net work out)/(Energy in)

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

$\lambda = \ell n 2/t_{1/2} = 0.693/t_{1/2}$

$t_{1/2}^{eff} = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$I = I_o e^{-\Sigma x}$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$SCR = S/(1 - K_{eff})$

$CR_x = C/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^{\ 2} = I_2 d_2^{\ 2}$

$R/hr = (0.5\ CE)/d^2$ (meters)

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
Density = 62.4 lbm/ft^3
Density = 1 gm/cm^3
Heat of vaporization = 970 Btu/lbm
Heat of fusion = 144 Btu/lbm
1 Atm = 14.7 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 5.01 (3.00)

a. MORE NEGATIVE [0.25] There is less boron to leave the core area per degree change of coolant temperature (or equivalent). [0.75] (1.0)

b. LESS NEGATIVE [0.25] The changes in resonant absorption by U238 become less as temperature increases (or equivalent). [0.75] (1.0)

c. MORE NEGATIVE [0.25] Boron concentration decreases, resulting in ~~less competition of neutrons for U238 resonant absorption (or equivalent)~~. [0.75] a more negative MTC. (1.0)

REFERENCE
IP-3 ECI Rx Theory; Chapter 5, Pages 27, 54, 56 and 67

ANSWER 5.02 (2.50)

a. M: The ratio of the total number of fission and source neutrons to the total number of neutrons which would exist due to the source only. (0.75)

b. As Keff approaches 1, M approaches infinity and cannot be used to predict criticality graphically. (0.75)

c. CR = 100(1-0.95 / 1-0.99) = 100(5) = 500 cps (1.0)

REFERENCE
IP-3 ECI Rx Theory - Chapter 4, Pages 53, 63, 74, 82 and 83

ANSWER 5.03 (2.00)

a. (2) Core axial flux profile [0.5] Rod worth is proportional to the neutron flux present. Less flux is present at the top and bottom areas of the core resulting in less rod worth in these areas. [1.5] (2.0)

REFERENCE
IP-3 ECI Rx Theory; Chapter 7, Pages 21, 22 and 27

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 5.04 (2.00)

a. DECREASES [0.5] Pu 239 concentration increases (while U 235 concentration decreases) [1.0]. (1.5)

b. LARGER SUR (0.5)

REFERENCE
Comprehensive Nuclear Training Operations, Fundamentals of Nuclear Reactor Physics, Chapter 7, Pages 33 to 38
IP-3 ECI Rx Theory, Chapter 4, Pages 15 and 32

ANSWER 5.05 (2.00)

a. $Power(2) = Power(1) * (N2/N1)^3 = 300 * (4)^3 = 19.2$ MW (0.5)

$Delta\ P(2) = Delta\ P(1) * (N2/N1)^2 = 50 * (4)^2 = 800$ psid (0.5)

$Flow(2) = Flow(1) * (N2/N1) = 880 * 4 = 3520$ gpm (0.5)

b. Answer: #1 (0.5)

REFERENCE
Thermal-Hydraulic Principles and Applications to the PWR, Chapter 10, Pages 10-32 to 41.
IP-3 Thermodynamics, Chapter 6, Pages 27-30, 35-36, and 41

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 5.06 (3.00)

a. Fission gasses pollute the Helium gas causing a reduction in gap thermal conductivity [0.5]. This results in increased fuel temperature change for a given power change, causing an increase in the magnitude of the coefficient [0.5]. (1.0)

b. Fuel densification causes a decrease in the fuel pellet dimension resulting in an increase in the fuel to clad gap dimension and higher fuel temperature [0.5]. This causes an increase in the magnitude of the coefficient [0.5]. (1.0)

c. Clad creep effectively shrinks the clad into closer contact with the fuel, increasing the gap thermal conductivity [0.5]. This results in a fuel temperature decrease and a lower value for the coefficient [0.5]. (1.0)

REFERENCE
Reactor Control for Large PWR's, Chapter 2, Pages 2-40 to 49.
IP-3 ECI Rx Theory, Chapter 5, Pages 56 through 59

ANSWER 5.07 (2.50)

a. NO (0.5)

b. Plant efficiency decreases because HP feed heaters are no longer providing an increase in feedwater temperature. [0.75] Reactor power must increase to make up for the lower feedwater enthalpy. [0.75] When steam flow is reduced to maintain reactor power less than 75%, actual generator megawatt output will be less than or equal to the original value. [0.5] (2.0)

REFERENCE
IP-3 Thermodynamics, Chapter 2, pages 32 through 35

ANSWER 5.08 (2.00)

a. Convection
b. Radiation/Convection (large Delta T) (either and/or)
c. Conduction
d. Convection (natural) [0.5 each] (2.0)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
IP-3 Thermodynamics, Chapter 8, pages 2, 28 and 30 through 34

ANSWER 5.09 (3.00)

a. Rod groups sequenced and overlapped.
b. Rod insertion limits adhered to.
c. Axial Flux Difference limits adhered to.
d. Rod to group allignment maintained. [0.75 each] (3.0)

REFERENCE
IP-3 TS, pages 3.10-10 and 11

ANSWER 5.10 (3.00)

a. SAME [0.25] Steam dumps will compensate for any additional heat added by the fourth RCP. RCS temperature/reactivity unchanged. (0.75)

b. ECP LOWER than ACP [0.25] Xenon will increase to near peak at 8 hours after trip. Rods must be higher to compensate. (0.75)

c. ECP LOWER than ACP [0.25] The corresponding temperature increase must be compensated by a higher critical rod position. (0.75)

d. ECP HIGHER than ACP [0.25] The reduction in temperature must be compensated by a lower rod position. (0.75)

REFERENCE
IP-3 Graphs Book, Section 1, Pages 4 and 8

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 6.01 (2.00)

a. TRUE
b. TRUE
c. FALSE
d. TRUE
e. FALSE [0.4 each] (2.0)

REFERENCE
IP-3 SD Plant Chemistry; Pages 13, 16 and 21

ANSWER 6.02 (3.00)

a. - Thermal Barrier CCW Header Lo Flow
- RCP Thermal Barrier Cooling Return Hi Temp
- Process Monitor Hi Radiation (and respective indicating light)
- Component Cooling Surge Tank No. 31/32 Level
- ~~(CAT)~~ Hi Letdown Temp [any 4 @ ~~0.4~~ (0.375) each] (1.5)

b. - Return high flow closes return isolation valve ~~(781)~~ (FCV-625)
- Check valve (774) isolates on reverse flow
- Relief valve (783) protects isolated piping [0.5 each] (1.5)

REFERENCE
IP-3 SD CCW, Pages 3, 4 and 20
PID 9321-F-27203-13

ANSWER 6.03 (2.50)

a. - Containment High Radioactivity (R-11 or R-12)
- High-high Containment Pressure (CSAS)
- ESF (SI)
- Manual Containment Spray
- Manual [0.4 each] (2.0)
- Vap.Cont. Iodine Activity (R-29 or Ch.2) [any 5 @ 0.4 each]
b. TRUE (FALSE accepted with Iodine design assumption.) (0.5)

REFERENCE
IP-3 SD Cont. Isol., Page 13 & 22
IP-3 SD Cont. Spray, Pages 3 and 4

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 6.04 (3.50)

a. - No D/G fault
- D/G voltage satisfactory
- No Bus 5A fault
- Loss of outside power confirmed (52/5A breaker open)
- Bus 5A undervoltage condition
- Bus tie breaker (2AT5A) open [any 5 @ 0.4 each] (2.0)

b. - SI pump 31
- Cont. Spray pump 31
- Service water pump 34
- Cont. Recirc fan 31
- Cont. Recirc fan 33
- CCW pump 31 [0.25 each, ~~all~~ 6 required] (1.5)
- Service ~~Water~~ pump 31

REFERENCE
IP-3 SD ESF, Pages 18 and 21

ANSWER 6.05 (3.00)

a. INCREASE [0.25] Current in affected quadrant increases with respect to average currents [0.75]

b. MORE NEGATIVE [0.25] Difference between (top-bottom) flux increases [0.75]

c. DECREASE [0.25] ~~(CAF)~~ [0.75] ΔI penalty enters OPΔT calculation (3.0)

REFERENCE
IP-3 SD Excore Instr., Figure 13-17
IP-3 SD Unit Protection, Page 10

ANSWER 6.06 (3.50)

a. - AUTOMATIC
- MANUAL [0.25 each] (0.5)

b. - Assure adequate trip reactivity (SDM). [0.5]
- Minimize effects of rod ejection accident. [0.5]
- Assure power distribution limits maintained. [0.5 each] (1.5)

c. 1) NONE
2) IN (NONE only if Channel B assumption is stated.)
3) IN ~~(CAF)~~ [0.25 each] (1.5)

REFERENCE
IP-3 SD RCCS, Pages 20 and 63 through 70
IP-3 TS, Page 3.10-15

ANSWER 6.07 (2.50)

a. Precludes brittle failure of RCS. (0.5)

b. At ~~330~~ 326 F [0.1] the block valves are opened [0.4] and the PORV trip relays are armed [0.5] at a pressure difference of 66 psig [0.3] between the (loop) pressure ~~[0.2]~~ and the pressure program, the PORVs will open to reduce pressure. [0.2] (1.5)

c. 325 F (326) (The following assumptions must be made for "b" to occur.
1) "States" links are installed
2) Block valves are available
3) PORVs are in automatic.) (0.5)

REFERENCE
IP-3 SD Pressurizer and PRT, pages 33 and 34
IP-3 POP 3.3, page 5

ANSWER 6.08 (3.00)

a. 1) Prevent condenser overpressure [0.33] and condenser tube impingement ~~[0.33]~~ [0.5] [/6]
2) Prevent operation in Temperatuare Mode unless an actual "large" load rejection occurs [0.33]. (1.0)

b. - (Condenser Circulating Water Pump Breaker Position) ~~[0.5]~~
- Condenser vacuum ~~[0.5]~~ [/.0] (1.0)

c. - Turbine control oil pressure low (45 psig) [0.5]
- Either 86 P or 86 U lockout relays energized [0.5] (1.0)

REFERENCE
IP-3 SD, Steam Dump and LP Bypass, Pages 4, 5, and 9

ANSWER 6.09 (2.00)

a. - FP suction (header) pressure
- FP discharge (header) pressure
- Mn.steam (header) pressure
- S/G steam flow [0.375 each] (1.5)

b. Runs back the pump speed for reduced suction pressures (315 psig to 280 psig) (0.5)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
IP-3 SD SGWLC; Pages 2 and 12

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 7.01 (3.50)

a. - Two or more rods fail to insert after a reactor trip.
- Uncontrolled cooldown below 540 F if one rod stuck out following a reactor trip.
- Uncontrolled cooldown below 500 F following a reactor trip.
- Control bank position below the bank insertion limit.
[0.5 each, all required] (2.0)

b. - Open Emergency Boration Valve (MOV-333) [0.5]
- Place operating BAT pump in fast speed [0.5]
- Increase charging pump speed to maximum [0.5] (1.5)

REFERENCE
PEP-CVCS-3, pages 1 and 2

ANSWER 7.02 (3.50)

a. - Containment spray (pumps and discharge valves) actuation.
- Containment Phase B actuation.
- Steam line isolation valve closure. [0.5 each] (1.5)

b. - Verify SI pump operation THEN
- Stop all RCPs. [0.5 each] (1.0)

c. - A leak is from the pressurizer vapor space.
- A bubble exists in the reactor vessel area. [0.5 each] (1.0)
- Adverse containment conditions [any 2]

REFERENCE
PEP-ES-1, pages 1, 5 and 6
PEP-ES-1C, page 5

ANSWER 7.03 (4.00)

a. - Depress the manual trip pushbuttons. (Counts as two if separated)
- Depress test cabinet pushbuttons.
- Open DC Distribution Panel circuits (P31-7 and P32-8).
- Open the reactor trip breakers locally.
- Open the MG set generator breakers locally. (Counts as two if separated)
- De-energize the MG sets locally (at the 480 volt switchgear).
- De-energize the 480 volt busses 2A and 6A. [0.4 each] (2.8)

b. - Depress the manual trip pushbutton.
- Initiate trip at turbine front standard.
- Close the MSIVs. [0.4 each] (1.2)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
PEP-RPC-1, pages 1, 2 and 3.

ANSWER 7.04 (3.00)

a. - Pressurizer temperature [0.1]
- Loop (WR) temperatures [0.3]
- Core exit thermocouples [0.2] ~~[all required @ 0.2 each]~~ (0.6)

b. No manifold flow exists for NR RTDs (0.4)

c. - S/G steam release with constant steam pressure.
- Core exit TCs below saturation temperature for existing RCS pressure and constant or decreasing.
- Cold leg temperatures near saturation for S/G pressure.
- Hot leg temperatures constant or decreasing (approximately the same as TCs).
- Loop Delta T not more than full power Delta T.
[four required @ 0.5 each] (2.0)

REFERENCE
ONOP-RCS-6, pages 2 and 4

ANSWER 7.05 (2.50)

- Ensure both PORVs are shut. [0.5]
- Ensure both spray valves are shut. [0.5]
- Ensure backup heaters are energized (if pressure <2185 psig). [0.5]
- Check auxiliary spray valve (212) shut [0.5] and either normal or alternate charging isolation valves (204A/B) are ~~closed.~~ open [0.5] (2.5)

REFERENCE
ONOP-RCS-2, page 2

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 7.06 (2.50)

a. Ensure adequate shutdown margin available. (0.75)

b. This indicates a possible excessive reactivity insertion (which may result in an undesired criticality). (0.75)

c. Expected hydrogen production (associated with ~~hydrogen~~ hydrazine use) may result in an explosive mixture. (0.5)

d. Hydrazine will expend the demineralizer resin. (CAF all) (0.5)

REFERENCE
PDP-1.1, pages 3 through 5

ANSWER 7.07 (3.00)

a. 1 each range (0.5)

b. 450 F (Or to right of Press/Temp Curve) (0.5)

c. 1 dpm (0.5)

d. 2 cps (0.5)

e. - Borate a sufficient amount [0.5]
- Recalculate the ECP [0.5] (1.0)

REFERENCE
PDP-1.2, pages 1, 2 and 7 and Curve RCS 1A

ANSWER 7.08 (3.00)

a. .5 - Adjust LD Pressure Control (PC-135) to maintain 50 psig.
.5 - Secure charging pump.
.5 - Secure RHR pumps.
.2 - Place EXLD in service.
.5 - Ensure PORVs properly operate.
.2 - Open 730/731 as soon as they close. [0.4 each, all required] (2.4)

b. 3 1/2 minutes (3-4 accepted) [2-5 for half credit] (0.6)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
POP-3.4, page 3

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 8.01 (1.00)

Establish a continuous fire watch within 1 hour.[0.5] (1.0)
[0.5]

REFERENCE
IP-3 TS, Page 3.14-2

ANSWER 8.02 (2.50)

a. 140 F, 10% [0.5 each] (1.0)

b. 1000 ppm (0.5)

c. All refueling operation must cease. (1.0)

REFERENCE
IP-3 TS, Pages 3.8-2 and 3

ANSWER 8.03 (2.00)

a. Immediately bring the plant to Hot Shutdown with RCS Tavg <500 F. (1.0)

b. Prevents atmospheric release via S/G if a S/G tube rupture were to occur (because the corresponding S/G Atm. relief setpoint is above S/G saturation pressure). (1.0)

REFERENCE
IP-3 TS, Page 3.1-14 and 15

ANSWER 8.04 (1.50)

a. 100 F

b. 200 F

c. 320 F [0.5 each] (1.5)

REFERENCE
IP-3 TS, Page 3.1-4

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

ANSWER 8.05 (3.00)

a. Negative MTC [0.75]

b. Pressure-temperature limits curve adhered to (to the right of) [0.75]

c. Tavg greater than (or equal to) 450 F [0.75]

d. Bubble in the pressurizer [0.75] (3.0)

REFERENCE
IP-3 TS, Page 3.1-12

ANSWER 8.06 (3.00)

- The intent of the original procedures is not altered. [1.0]

- The change is approved by two members of the plant staff, at least one of whom holds a Senior Reactor Operator's license on the unit affected. [1.0]

- The change is documented, reviewed by the PORC [0.5] and approved by the Resident Manager within 14 days of implementation. [0.5] (3.0)

REFERENCE
IP-3 TS, Page 6-13a

ANSWER 8.07 (3.50)

a. Area with levels between 100 and 1000 mrem/hr. (1.0)

b. - A radiation monitoring device which continuously indicates the radiation dose rate in the area.

- A radiation monitoring device which continuously integrates the radiation dose rate in the area and alarms when a preset integrated dose is received. Entry into such areas with this monitoring device may be made after the dose rate level in the area has been established and personnel have been made knowledgeable of them.

- An individual qualified in radiation protection procedures who is equipped with a radiation dose rate monitoring device. This individual shall be responsible for providing positive control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by the facility Health Physicist in the Radiation Work Permit.
[One of the above answers required.] (1.5)

c. Doors must be locked [0.5] and the keys must be maintained under administrative control [0.5] (of the SS or Env. Supr.) (1.0)

REFERENCE
IP-3 TS, Page 6-20

ANSWER 8.08 (3.50)

a. 50,000 gpm (0.25)

b. Operations Supt. (0.25)

c. 1) - R-19 Operable [0.5]
- S/G sampled daily (Once/watch if activity high) [0.5]

2) - Flow Meters in Service [0.5]
- Estimated flow based on valve position every 4 hours [0.5]

3) - 10,000 gpm [0.5]
- Ops. Supt. and Rad. & Env Serv. Supt concurrence [0.5]
(Either answer acceptable for 1-3) (1.5)

d. - 2 independent samples [0.5]
- 2 independent release calculation verification [0.5]
- 2 independent valve lineup verifications. [0.5] (1.5)

ANSWERS -- INDIAN POINT 3 -85/04/23-SAILOR, B.

REFERENCE
AP-11, Pages 1-5

ANSWER 8.09 (2.50)

a. (2) (0.5)

b. DO NOT OPERATE TAG (0.5)

c. 1) Operations Superintendent, Supt. of Power, PORC [0.33 each] (1.0)

2) Shift Supervisor (0.5)

REFERENCE
AP-13, Pages 1-3

ANSWER 8.10 (2.50)

a. Operations Supt. (0.5)

b. - Dosimeter at 3/4 scale
- Unplanned evacuation alarm
- Communications failure
- ESF actuation
- (CAF others) [0.5 each, any 3] (1.5)

c. (6) (0.25)

d. (2) (0.25)

REFERENCE
IP-3 SOP-CB-2, Pages 1-4

ATTACHMENT 2

CHANGES MADE TO WRITTEN EXAM DURING EXAMINATION REVIEW:

RO EXAM

Answer No.	Change
1.04b	Added additional plausible answer per IP3 POP1.2, page 8.
2.05a	Added additional plausible answer per IP-3 Ventilation and Containment logic Drawings.
3.09b	Added additional plausible answers per IP-3 FSAR.
4.03a	Added additional plausible answers per IP-3 ES-1C, page 1.

SRO EXAM

6.03a	Added additional plausible answer per IP-3 SD Containment Isolation, page 22.
6.07b.	Added three assumptions per IP-3 POP 3.3, page 5.
7.02c	Same as 4.03a above.