UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

JUL 6 1992

Docket No. 50-285
License No. DPR-40

Omaha Public Power District
ATTN: W. G. Gates, Division Manager
Nuclear Operations
444 South 16th Street Mall
Mail Stop 8E/EP4
Omaha, NE 68102-2247

Gentlemen:

SUBJECT: GENERIC FUNDAMENTALS EXAMINATION RESULTS

This letter forwards the results of the Generic Fundamentals Examination Section (GFES) of the written operator licensing examination that was administered on June 10, 1992, to nominated employees of your facility. We are forwarding the following items:

- the examinations, including answer keys,
- the results for your nominated employees, and
- copies of the individual answer sheets completed by your nominated employees

We request that your training department forward the individual answer sheets and results to the appropriate individuals. It should be noted that the examination was administered in two forms, which were identical except for the sequence of questions.

In accordance with the Commission's regulations, 10 CFR 2.790, a copy of this letter and the examination and answer key will be placed in the NRC's Public Document Room (PDR). The individual results and answer sheets are exempt from public disclosure and therefore will not be placed in the PDR.

Questions concerning this examination should be directed to Dr. George Usova at (301) 504-1064.

Sincerely,

A. Bill Beach, Director
Division of Reactor Projects

Enclosures: As stated

cc: next page

IE42

cc w/enclosures:
Omaha Public Power District
ATTN: J. K. Gasper, Training Manager
P.O. Box 399
Fort Calhoun, NE 68023

bcc w/o enclosures:

DRP Section Chief
S. Bloom, NRR Project Manager (MS: 11-D-23)
RIV File
L. Miller, TTC
J. L. Milhoan, RA
J. L. Pellet: Rdg file

bcc w/enclosures:

DMB (IE42)
L. A. Hurley: GFES file

RIV:OLS:LA	C:OLS	D:DRS	D:DRP
LAHurley	JLPellet	SJCollins	ABBeach
07/01/92	07/01/92	07/2/92	07/2/92

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JUNE 1992 GENERIC FUNDAMENTALS EXAM
PRESSURIZED WATER REACTOR

FORM A	FORM B	ANS
1	29	A
2	30	A
3	31	D
4	32	C
5	33	D
6	34	B
7	35	D
8	36	D
9	37	D
10	38	A
11	39	C
12	40	B
13	41	A
14	42	D
15	43	C
16	44	D
17	45	D
18	46	A
19	47	B
20	48	C
21	49	D
22	50	A
23	51	B
24	52	B
25	53	C
26	54	C
27	55	B
28	56	C
29	57	D
30	58	C
31	59	B
32	60	D
33	61	B
34	62	D
35	63	A
36	64	D
37	65	D
38	66	C
39	67	C
40	68	C
41	69	A
42	70	B
43	71	C
44	72	A
45	73	D
46	74	D
47	75	C
48	76	D
49	77	C
50	78	A
51	79	D
52	80	A
53	81	C
54	82	D
55	83	A
56	84	B
57	85	A
58	86	A
59	87	B
60	88	A
61	89	C
62	90	A
63	91	A
64	92	C
65	93	A
66	94	B
67	95	D
68	96	C
69	97	B
70	98	B
71	99	B
72	100	A
73	1	C
74	2	B
75	3	B
76	4	D
77	5	B
78	6	D
79	7	C
80	8	C
81	9	C
82	10	B
83	11	B
84	12	B
85	13	C
86	14	A
87	15	D
88	16	C
89	17	D
90	18	D
91	19	C
92	20	A
93	21	B
94	22	B
95	23	B
96	24	C
97	25	B
98	26	A
99	27	B
100	28	B

NRC GENERIC FUNDAMENTALS EXAMINATION
CHECKLIST - PWR

_____1. Verify receipt of PWR examination, form A and B.

_____2. Verify each examination form has:

- Cover sheet (page 1)
- Rules and guidelines (page 2)
- Equations and conversions handout (page 3)

_____3. Verify each examination contains 100 questions.

- Form A (pages 4 through 46)
- Form B (pages 4 through 47)

UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 1992 - FORM A

Please Print:

Name: _____

Facility: _____

ID Number: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO CANDIDATE

Use the answer sheet provided. Each question has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 2.5 hours after the examination starts.

SECTION	QUESTIONS	% OF TOTAL	SCORE
COMPONENTS	1 - 44		
REACTOR THEORY	45 - 72		
THERMODYNAMICS	73 - 100		
TOTALS	100		

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

_____
Candidate's Signature

RULES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

1. Print your name in the blank provided on the cover sheet of the examination.

2. Fill in the name of your facility.

3. Fill in the ID Number you were given at registration.

4. Fill in your start and stop times at the appropriate time.

5. Two aids are provided for your use during the examination:

   (1) An equations and conversions sheet contained within the examination copy, and

   (2) Steam tables provided by your proctor.

6. Use only the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.

7. Scrap paper will be provided for calculations.

8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.

10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have not received or been given any assistance in completing the examination.

11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then examination aids - steam table booklets, handouts and scrap paper used during the examination.

12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATIONS SECTION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

$\dot{Q} = \dot{m}c_p\Delta T$

$\dot{Q} = \dot{m}\Delta h$

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

$SUR = 26.06/\tau$

$SUR = \dfrac{26.06(\lambda_{eff}\rho)}{(\beta - \rho)}$

$P = P_0 10^{SUR(t)}$

$P = P_0 e^{(t/\tau)}$

$\tau = (l^*/\rho) + [(\bar{\beta} - \rho)/\lambda_{eff}\rho]$

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

$\rho = \Delta K_{eff}/K_{eff}$

$\text{Cycle Efficiency} = \dfrac{\text{Net Work (out)}}{\text{Energy (in)}}$

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

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = \dfrac{(1 - K_{eff})_0}{(1 - K_{eff})_1}$

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

$Pwr = W_f\dot{m}$

$\tau = l^*/(\rho - \bar{\beta})$

$l^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

$$v(P_e - P_i) + \frac{(\bar{v}_e^2 - \bar{v}_i^2)}{2} + g(z_e - z_i) = 0$$

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 BTU	=	778 ft-lbf	°F	=	9/5 °C + 32
°C	=	5/9(°F - 32)			

QUESTION: 1

Which one of the following valves provides overpressure protection to limit the internal pressure in vessels and thus protect personnel and equipment?

A. Safety

B. Control

C. Sentinel

D. Pressure regulating

QUESTION: 2

Refer to the drawing of a hydraulically-operated valve that is shown in a throttled position (see figure on next page).

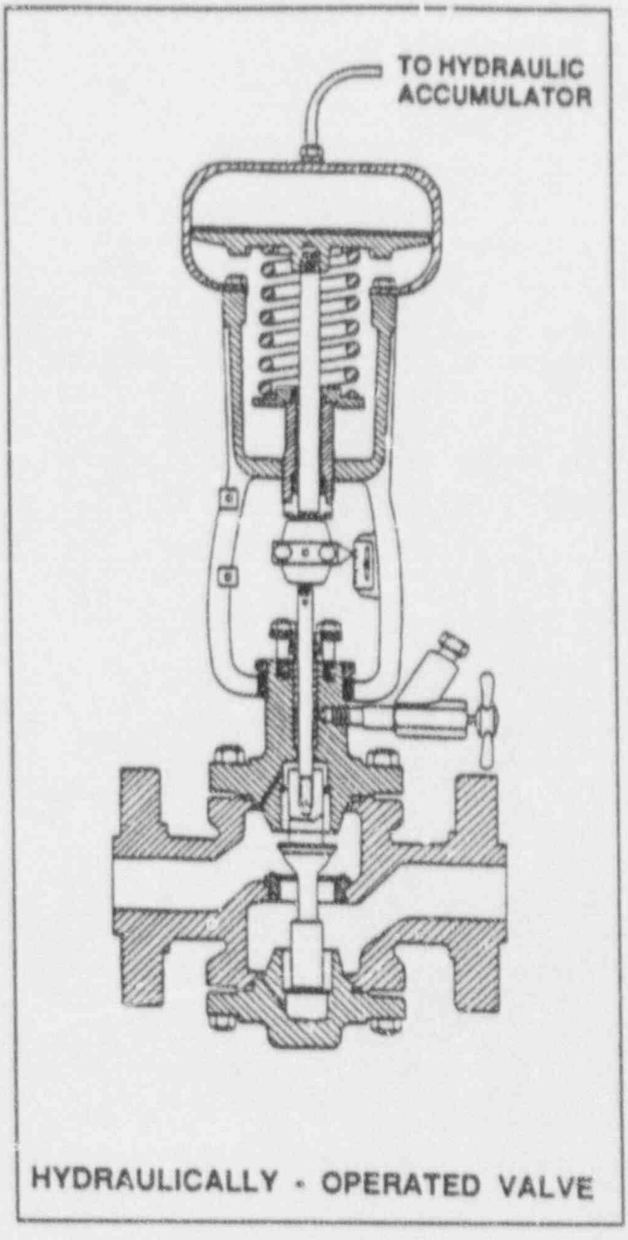
Select the position of this valve following a loss of hydraulic fluid pressure.

A. Fully open

B. As is

C. Fully closed

D. Mid-position



HYDRAULICALLY - OPERATED VALVE

QUESTION: 3

An operator attempts to close a fully-open manual gate valve to isolate a pump in a cooling water system that has been cooled down for maintenance. However, the operator is unable to manually rotate the handwheel in the close direction.

Which one of the following could cause this condition?

A. A hydraulic lock has developed under the valve disk.

B. A hydraulic lock has developed in the valve bonnet between the valve disk and its backseat.

C. The two halves of the valve disk have expanded and are jammed against the valve seats.

D. The valve disk has jammed against its backseat by the difference in the thermal contraction of the stem and the bonnet.

QUESTION: 4

To verify a manual valve in an operating system is <u>closed</u>, the operator should operate the valve handwheel in the:

A. open direction until the valve is fully open, then close it using normal force.

B. open direction until flow sounds are heard, then close the valve using normal force.

C. close direction using normal force and verify there is no substantial handwheel movement.

D. close direction until it stops, then close it an additional one-half turn using additional force if necessary.

QUESTION: 5

A liquid flow rate detector was installed with its low-pressure sensing line filled with air and its high-pressure sensing line filled with water. If the detector is placed in service in an operating system, indicated flow rate will be:

A. zero.

B. equal to actual flow rate but greater than zero.

C. lower than actual flow rate.

D. higher than actual flow rate.

QUESTION: 6

Which one of the following will cause indicated volumetric flow rate to be lower than actual volumetric flow rate using a differential pressure flow detector that is connected to a calibrated orifice?

A. System pressure decreases.

B. The orifice erodes over time.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

QUESTION: 7

A differential (D/P) detector is being used to measure main steam flow rate. At a steam flow rate of 5×10^6 lbm/hr measured D/P is 40 psid.

If steam flow changes such that current D/P is 30 psid, what is the current steam flow rate?

A. 2.11×10^6 lbm/hr

B. 3.54×10^6 lbm/hr

C. 3.75×10^6 lbm/hr

D. 4.33×10^6 lbm/hr

QUESTION: 8

Which one of the following flow devices produces the largest unrecoverable head loss when used in an operating fluid system?

A. Venturi

B. Flow nozzle

C. Pipe elbow

D. Orifice

QUESTION: 9

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

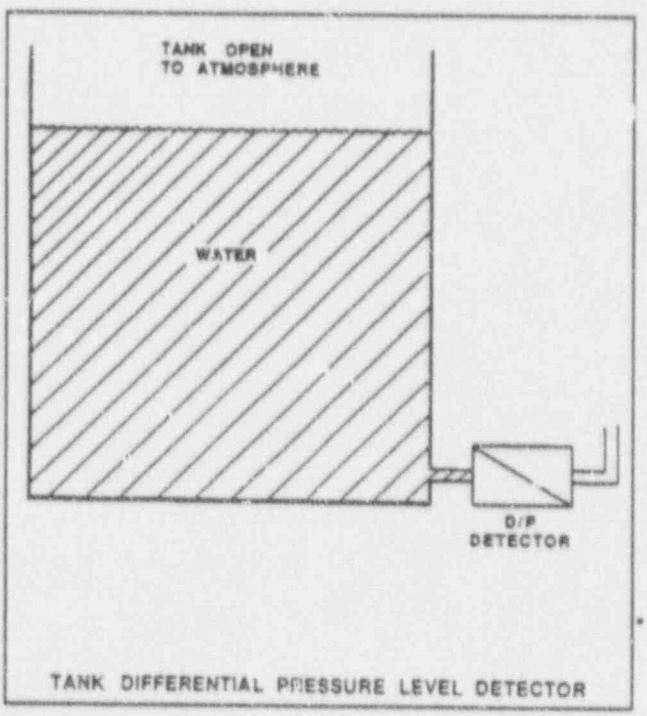
The associated level instrument was calibrated with the water in the tank at 100°F. If mass in the tank remains constant and the water temperature increases to 120°F, the indicated level will:

A. increase in direct proportion to the temperature rise.

B. increase but remain less than actual level.

C. decrease in direct proportion to the temperature rise.

D. remain the same although actual level increases.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 10

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

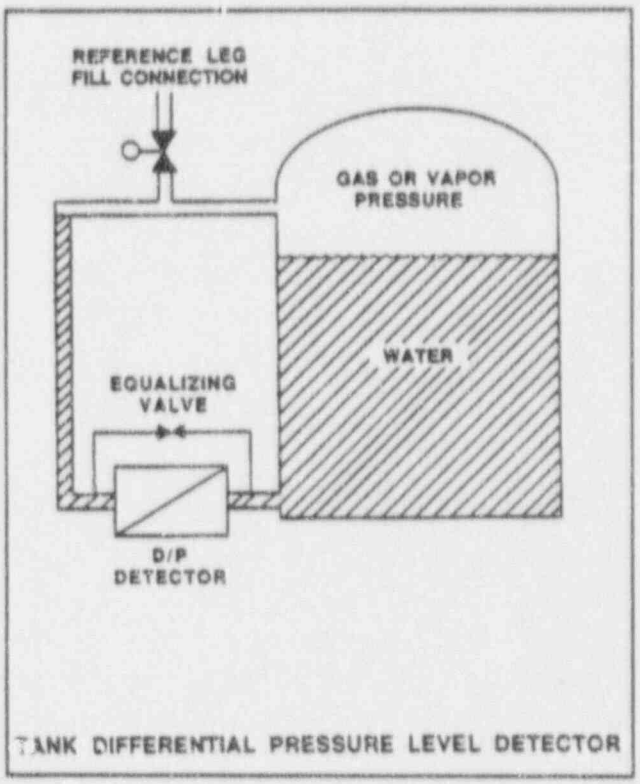
The D/P sensed by the detector is _____ proportional to the temperature of the water in the tank if _____ is constant.

A. directly; level

B. inversely; level

C. directly; mass

D. inversely; mass



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 11

Refer to the drawing of a steam generator differential pressure level detector (see figure below).

With the reactor shutdown, steam generator (S/G) pressures are inadvertently decreased from 900 psig to 700 psig in 5 minutes due to operator error.

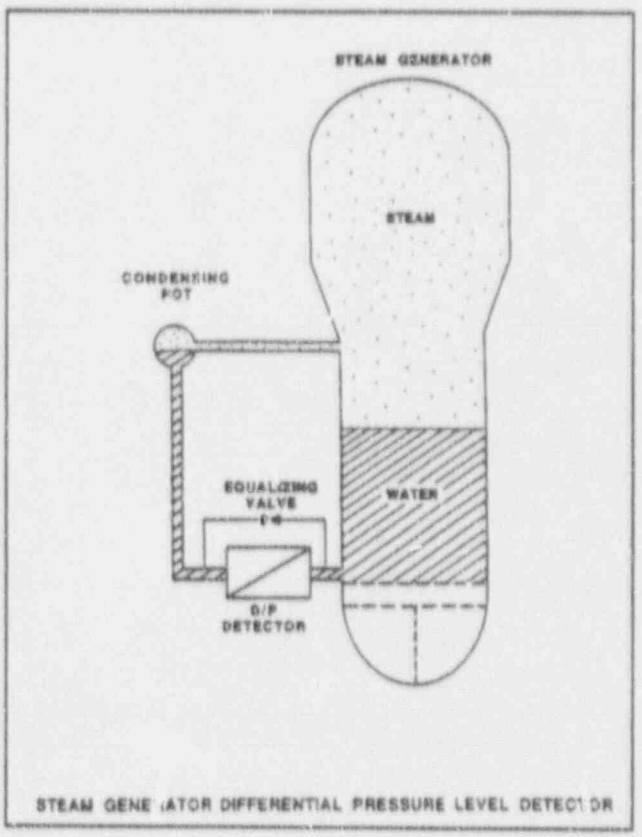
After the S/G pressures stabilize, indicated S/G level will be _____ than actual level if reference leg flashing occurs, and after the condensing pot refills, indicated level will _____.

A. higher; stabilize above actual level

B. lower; stabilize below actual level

C. higher; decrease and stabilize near the actual level

D. lower; increase and stabilize near the actual level



STEAM GENERATOR DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 12

A simple bellows pressure detector is located in the reactor containment with its low pressure side vented to the containment. If a main steam break raises containment pressure by 40 psig, the associated pressure indication (disregarding any temperature effect on the bellows) will:

A. increase by 40 psig.

B. decrease by 40 psig.

C. increase by the square root of 40 psig.

D. decrease by the square root of 40 psig.

QUESTION: 13

If shorting occurs within a resistance temperature detector (RTD), indication will fail:

A. low.

B. high.

C. as is.

D. to midscale.

QUESTION: 14

Which one of the following is commonly used as a coating on the inner surface of a fission chamber for the purpose of neutron detection?

A. U_3O_8 coating of natural enrichment on both electrode surfaces

B. U_3O_8 coating with highly enriched U-235 on both electrode surfaces

C. U_3O_8 coating of natural enrichment on the inner surface of the chamber

D. U_3O_8 coating of highly enriched U-235 on the inner surface of the chamber

QUESTION: 15

In an automatic flow controller, the range of values around the setpoint of a measured variable where no action occurs is called:

A. bias.

B. error.

C. deadband.

D. deviation.

QUESTION: 16

An emergency diesel generator (D/G) is the only power source connected to its emergency bus. The governor of the D/G directly senses D/G _____ and directly adjusts D/G _____ flow to maintain a relatively constant D/G frequency.

A. load; air

B. load; fuel

C. speed; air

D. speed; fuel

QUESTION: 17

Which one of the following describes the response of a direct-acting derivative controller, operating in automatic, to an increase in the controlled parameter above the controller setpoint?

A. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller setpoint, at which time the output signal becomes constant.

B. The controller will develop an output signal that will remain directly proportional to the difference between the controlled parameter and the controller setpoint.

C. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller setpoint, at which time the output signal becomes zero.

D. The controller will develop an output signal that will remain directly proportional to the rate of change of the controlled parameter.

QUESTION: 18

In a proportional controller, the term "offset" refers to the difference between the:

A. control point and setpoint.

B. control point and proportional band.

C. deadband and setpoint.

D. deadband and proportional band.

QUESTION: 19

What precaution must be observed when transferring a valve controller from the automatic mode to the manual mode of control?

A. Ensure that a substantial deviation is established between the automatic mode and the manual mode.

B. Ensure that the valve controller output signals are matched between the automatic mode and the manual mode.

C. Ensure that the automatic valve controller signal is increasing before transferring to the manual mode of control.

D. Ensure that the automatic valve controller signal is decreasing before transferring to the manual mode of control.

QUESTION: 20

Which one of the following is not a normal indication of a gas/vapor bound motor-operated centrifugal pump that is operating in a cooling water system?

A. Fluctuating pump discharge pressure

B. Reduced system flow rate

C. Increased pump motor current

D. Increased pump noise level

QUESTION: 21

When a centrifugal pump is operating at shutoff head, it is pumping at _____ capacity and _____ discharge head.

A. maximum; minimum

B. maximum; maximum

C. minimum; minimum

D. minimum; maximum

QUESTION: 22

The available net positive suction head for a pump may be expressed as:

A. suction pressure minus saturation pressure of the fluid being pumped.

B. suction pressure plus discharge pressure.

C. discharge pressure minus saturation pressure of the fluid being pumped.

D. discharge pressure minus suction pressure.

QUESTION: 23

A centrifugal pump is operating in a closed system with all valves fully open. If the pump discharge valve is throttled 75% closed, pump motor current will:

A. increase and stabilize at a higher value.

B. decrease and stabilize at a lower value.

C. increase briefly, then return to original value.

D. decrease briefly, then return to original value.

QUESTION: 24

Which one of the following is an indication of pump runout?

A. Low pump flow rate

B. High pump vibration

C. Low pump motor current

D. High pump discharge pressure

QUESTION: 25

A variable-speed positive displacement pump is operating at 100 rpm with a flow rate of 60 gpm in an open system. To decrease pump flow rate to 30 gpm, pump speed must be decreased to approximately:

A. 25 rpm.

B. 30 rpm.

C. 50 rpm.

D. 71 rpm.

QUESTION: 26

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the combination of two pump/system operating conditions.

Two identical constant-speed centrifugal pumps are operating in series in an open system when one pump trips.

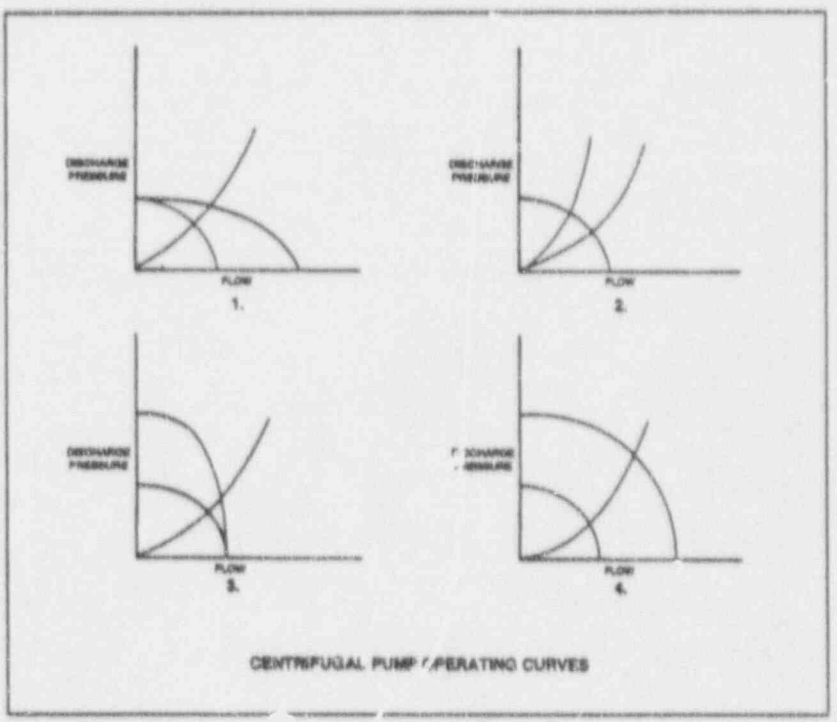
Which set of operating curves depicts the "before" and "after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.



CENTRIFUGAL PUMP OPERATING CURVES

QUESTION: 27

Which one of the following is not an indication of a locked reactor coolant pump rotor?

A. Low reactor coolant system flow trip

B. Decreased flow rate in unaffected loop(s)

C. Reactor coolant system pressure transient

D. Increased reactor coolant pump amps with possible breaker trip

QUESTION: 28

A main generator is operating in parallel with the power grid. If the voltage supplied to the generator field is slowly and continuously decreased, the generator will experience high current due to: (Assume no generator protective actuations occur.)

A. excessive generator Mwe.

B. excessive generator KVAR (lagging).

C. excessive generator KVAR (leading).

D. generator reverse power.

QUESTION: 29

A centrifugal pump is operating with the following parameters:

Speed	= 1,800 rpm
Current	= 40 amperes
Pump Head	= 20 psi
Pump Flow Rate	= 400 gpm

What will be the new value of pump head and current if the speed is increased to 2,000 rpm?

A. 22 psi, 49 amps

B. 22 psi, 55 amps

C. 25 psi, 49 amps

D. 25 psi, 55 amps

QUESTION: 30

The starting current in an AC induction motor is much higher than the full-load running current because:

A. the rotor does not develop maximum induced current flow until it has achieved synchronous speed.

B. resistance is added to the electrical circuit after motor start to limit running current.

C. the stator is essentially a short circuit until a voltage is developed in the rotor.

D. a large amount of electrical power is required to initially establish a rotating magnetic field.

QUESTION: 31

The frequency of large AC motor starts should be limited to prevent excessive:

A. wear of motor thrust bearings.

B. heat buildup within the motor windings.

C. torsional stresses on the motor shaft.

D. arcing and degradation of motor breaker contacts.

QUESTION: 32

Whenever possible, a heat exchanger should be placed in service by introducing both fluids gradually and simultaneously to:

A. maximize the heat transferred across the heat exchanger tubes.

B. minimize boiling of the cooling water in the heat exchanger tubes.

C. provide maximum temperature control of the system being cooled.

D. prevent excessive thermal stresses in the heat exchanger.

QUESTION: 33

Refer to the drawing of a lube oil heat exchanger (see figure below).

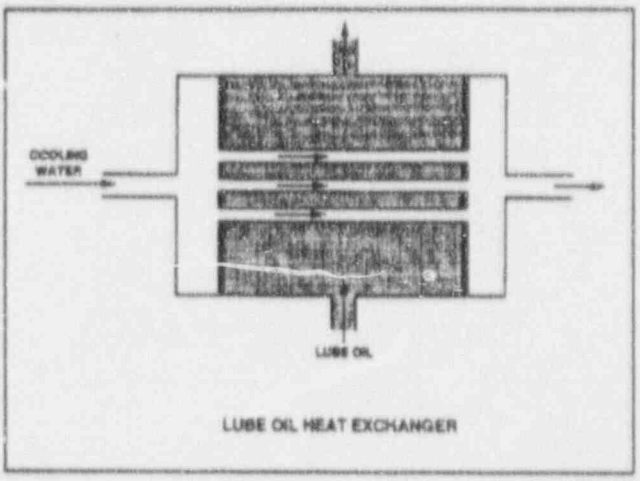
If scaling occurs inside the cooling water tubes, cooling water outlet temperature will _____ and oil outlet temperature will _____. (Assume oil and cooling water flow rates remain the same.)

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase



QUESTION: 34

Refer to the drawing of an operating cooling water system (see figure below).

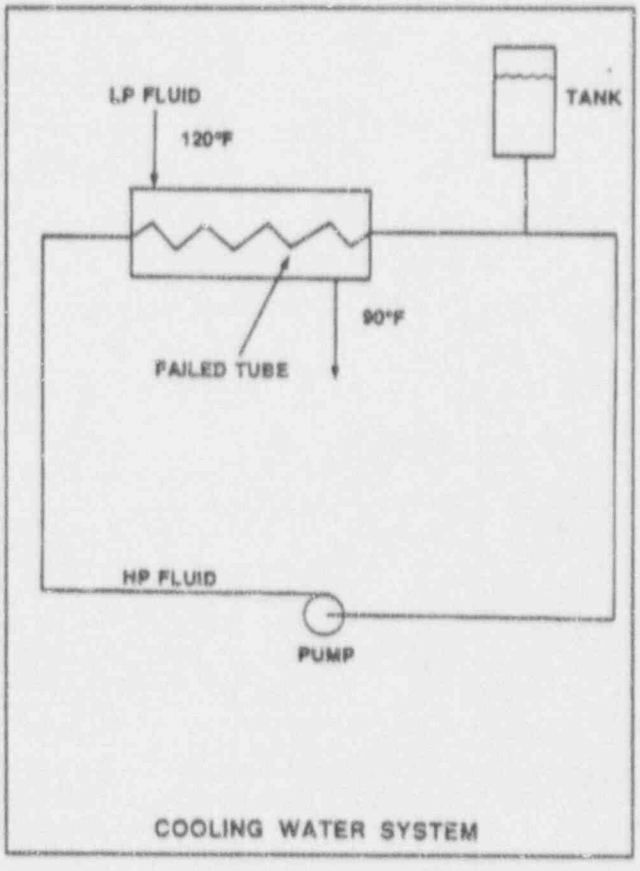
Which one of the following effects would occur as a result of a tube failure in the heat exchanger?

A. Level in the tank increases.

B. Flow in the low pressure system reverses.

C. Pressure in the low pressure system decreases.

D. LP fluid heat exchanger outlet temperature decreases.



QUESTION: 35

A demineralizer is being used in a water purification system. How will the accumulation of suspended solids in the demineralizer affect performance of the demineralizer?

A. The rate of unwanted ion removal from the system will decrease.

B. The flow rate of water through the demineralizer will increase.

C. The number of ion exchange sites will decrease.

D. The rate of resin depletion will increase.

QUESTION: 36

The ion exchange efficiency of a condensate demineralizer is determined by performing a calculation using the:

A. change in pH at the outlet of the demineralizer over a period of time.

B. change in conductivity at the outlet of the demineralizer over a period of time.

C. demineralizer inlet and outlet pH.

D. demineralizer inlet and outlet conductivity.

QUESTION: 37

The plant is operating at 70% equilibrium power level when the temperature of reactor coolant letdown passing through a boron-saturated mixed bed ion exchanger is <u>decreased</u> by 20°F.

As a result, the boron concentration in the effluent of the ion exchanger will _____ because the affinity of the ion exchanger for boron atoms has _____.

A. increase; decreased

B. increase; increased

C. decrease; decreased

D. decrease; increased

QUESTION: 38

Which one of the following functions or capabilities would remain following a loss of control power to a typical 480 VAC bus feeder breaker?

A. Remote breaker control capability

B. Breaker closing spring automatic recharging capability

C. Remote bus voltage indication

D. Remote breaker position indication

QUESTION: 39

Which one of the following available local circuit breaker indications will provide the most reliable and positive indication that a bus feeder breaker is open? (Assume the following indications and mechanisms are operating properly.)

A. Load-side ammeter and overcurrent trip flags

B. Load-side ammeter and load-side voltage

C. OPEN/CLOSED mechanical flag indication and load-side voltage

D. OPEN/CLOSED mechanical flag indication and overcurrent trip flags

QUESTION: 40

Under which one of the following preexisting conditions will closing a circuit breaker between two electrical generators cause a sudden large and possibly damaging mechanical torque to be exerted on both of the generators?

A. One generator is supplying a 3% higher voltage than the other.

B. One generator is supplying a 3% higher frequency than the other.

C. The voltage of one generator is out of phase with the other.

D. The capacity of one generator is twice that of the other generator.

QUESTION: 41

Refer to the drawing of a typical valve control circuit (see figure below).

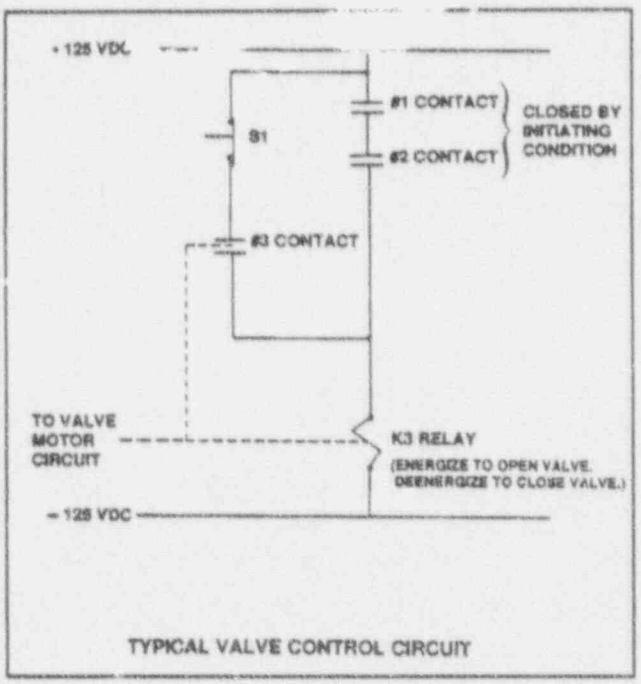
Which one of the following describes the function of the #3 contact?

A. To keep the K-3 relay energized after the initiating condition clears.

B. To provide a method for manually energizing the K-3 relay.

C. To increase circuit reliability as any one of three contacts can energize the K-3 relay.

D. To ensure the K-3 relay can always be deenergized even with the initiating condition present.



TYPICAL VALVE CONTROL CIRCUIT

QUESTION: 42

Closing the output breaker of the main generator with the frequency of the generator higher than grid frequency will result in the generator:

A. picking up a portion of the grid reactive load (MVAR).

B. picking up a portion of the grid real load (MWe).

C. behaving as a reactive load to the grid.

D. behaving as a real load to the grid.

QUESTION: 43

The function of high voltage electrical disconnects is to isolate equipment electrically during _____ conditions.

A. overcurrent

B. undervoltage

C. no-load

D. all normal and abnormal

QUESTION: 44

The following indications are observed for a motor breaker in the control room:

Red position indicating light - OFF
Green position indicating light - OFF
Load amps indicate normal load current

Assuming one of the indicating lights is burned out, what is the condition of the breaker?

A. Shut and racked in

B. Open and racked in

C. Shut and racked to "test" position

D. Open and racked to "test" position

QUESTION: 45

A thermal neutron exists at an energy _____ the epithermal range and its cross section for absorption in U-235 _____ as the neutron energy decreases.

A. above; decreases

B. above; increases

C. below; decreases

D. below; increases

QUESTION: 46

Which one of the following combinations of critical core conditions indicates the most excess reactivity exists in the core?

	CONTROL ROD (CEA) POSITION	RCS BORON CONCENTRATION
A.	25% inserted	500 ppm
B.	50% inserted	500 ppm
C.	25% inserted	1000 ppm
D.	50% inserted	1000 ppm

QUESTION: 47

A reactor at end of life has been shutdown from 100% power and cooled down to 140°F over 3 days. During the cooldown, Boron concentration was increased by 100 ppm. Given the following absolute values of reactivities added during the cooldown, assign a (+) or (-) as appropriate and choose the current value of shutdown margin.

Control Rods (CEAs)	= ( )	6.918% ΔK/K
Xenon	= ( )	2.675% ΔK/K
Power Defect	= ( )	1.575% ΔK/K
Boron	= ( )	1.040% ΔK/K
Temperature	= ( )	0.500% ΔK/K

A. -8.558% ΔK/K

B. -6.358% ΔK/K

C. -3.208% ΔK/K

D. -1.128% ΔK/K

QUESTION: 48

Over core life, plutonium isotopes are produced with delayed neutron fractions that are _____ than uranium delayed neutron fractions, thereby causing reactor power transients to be _____ near the end of core life.

A. larger; slower

B. larger; faster

C. smaller; slower

D. smaller; faster

QUESTION: 49

A reactor is operating at 75% power with the following conditions:

Power defect	=	-0.0157 ΔK/K
Shutdown margin	=	0.0241 ΔK/K
Effective delayed neutron fraction	=	0.0058
Effective prompt neutron fraction	=	0.9942

How much positive reactivity must be added to take the reactor "prompt critical"?

A. 0.0157 ΔK/K

B. 0.0241 ΔK/K

C. 0.0058 ΔK/K

D. 0.9942 ΔK/K

QUESTION: 50

Under which one of the following conditions is a reactor core most likely to have a positive moderator temperature coefficient?

A. Low coolant temperature at beginning-of-life

B. Low coolant temperature at end-of-life

C. High coolant temperature at beginning-of-life

D. High coolant temperature at end-of-life

QUESTION: 51

During an RCS cooldown, positive reactivity is added to the core (assuming a negative moderator temperature coefficient). This is partially due to:

A. a decrease in the thermal utilization factor.

B. an increase in the thermal utilization factor.

C. a decrease in the resonance escape probability.

D. an increase in the resonance escape probability.

QUESTION: 52

The amount of boric acid required to increase the coolant boron concentration by 50 ppm at BOL conditions (1200 ppm) is approximately _____ as the amount of boric acid required to increase boron concentration by 50 ppm at EOL (100 ppm).

A. the same

B. four times as large

C. eight times as large

D. twelve times as large

QUESTION: 53

Given the following initial parameters:

Total power coefficient	= -0.016% Δk/k/percent
Boron worth	= -0.010% Δk/k/ppm
Rod worth	= -0.030% Δk/k/inch
Initial RCS boron concentration	= 500 ppm

Which one of the following is the final RCS boron concentration required to support increasing plant power from 30% to 80% by boration/dilution with 10 inches of outward control rod (CEA) motion. (Assume no change in xenon reactivity.)

A. 390 ppm

B. 420 ppm

C. 450 ppm

D. 470 ppm

QUESTION: 54

The reactor is exactly critical below the point of adding heat (POAH) during a reactor startup at the end of core life. Control rods (CEAs) are withdrawn for 20 seconds to establish a 0.5 dpm startup rate.

Reactor power will increase:

A. continuously until control rods are reinserted.

B. and stabilize at a value slightly below the POAH.

C. temporarily, then stabilize at the original value.

D. and stabilize at a value slightly above the POAH.

QUESTION: 55

As moderator temperature decreases, the magnitude of differential rod worth will:

A. decrease due to shorter neutron migration length.

B. increase due to better moderation of neutrons.

C. decrease due to increased resonance absorption of neutrons.

D. increase due to increased neutron absorption in moderator.

QUESTION: 56

After a control rod (CEA) is fully inserted (from the fully withdrawn position), the effect on the axial flux shape is minimal. This is because:

A. the differential rod worth is constant along the length of the control rod.

B. the fully inserted control rod is an axially uniform poison.

C. a control rod only has reactivity worth if it is moving.

D. a variable poison distribution exists throughout the length of the control rod.

QUESTION: 57

The control rod (CEA) insertion limits are power dependent because the magnitude of:

A. power defect increases as power increases.

B. control rod worth decreases as power increases.

C. Doppler (fuel temperature) coefficient decreases as power increases.

D. moderator temperature coefficient increases as power increases.

QUESTION: 58

Immediately after a reactor trip from sustained high power operation, Xenon-135 concentration in the reactor will:

A. increase due to the decay of iodine already in the core.

B. decrease because xenon is produced directly from fission.

C. remain the same because the decay of iodine and xenon balance each other out.

D. decrease immediately, then slowly increase due to the differences in the half-lives of iodine and xenon.

QUESTION: 59

A reactor was operating for 42 weeks at a stable reduced power level when a reactor trip occured. The reactor was returned to critical after 12 hours and then ramped to 60% power in 6 hours.

How much time at steady state 60% power will be required to reach equilibrium xenon?

A. 20 to 30 hours

B. 40 to 50 hours

C. 70 to 80 hours

D. Unable to determine without knowledge of previous power history

QUESTION: 60

Two identical reactors have been operating at a constant power level for 1 week. Reactor A is at 50% power and Reactor B is at 100% power.

If both reactors trip/scram at the same time, Xe-135 will peak first in reactor _____ and the highest Xe-135 reactivity peak will occur in reactor _____.

A. A; B

B. A; A

C. B; B

D. B; A

QUESTION: 61

Which one of the following will cause reactor power to slowly fluctuate between the top and bottom of the core with steady state steam demand?

A. Feedwater variations

B. Dropped center control rod (CEA)

C. Xenon oscillation

D. Samarium oscillation

QUESTION: 62

A reactor startup is being performed 5 hours after a reactor scram from 100% equilibrium power. The plant is being returned to rated power at 2.0%/min instead of the normal rate of 0.5%/min.

At the faster rate of power increase, the minimum amount of core xenon will occur _____ and the amount of equilibrium core xenon will be _____.

A. sooner; the same

B. sooner; smaller

C. later; the same

D. later; smaller

QUESTION: 63

A reactor has been operating at full power for several days when it is shut down rapidly (within 2 hours) for maintenance. How will core xenon reactivity change?

A. Peak in 6 to 10 hours and then decay to near zero in 3 to 4 days.

B. Peak in 6 to 10 hours and then decay to near zero in about 1 day.

C. Peak in 2 to 4 hours and then decay to near zero in 3 to 4 days.

D. Peak in 2 to 4 hours and then decay to near zero in about 1 day.

QUESTION: 64

The reactor is near the end of its fuel cycle. Reactor power and coolant temperature are being allowed to "coastdown."

Why is boron dilution no longer used to compensate for fuel depletion?

A. Boron concentration has become so high that very large amounts of boron must be added to produce a small change in boron concentration.

B. The reactivity worth of the boron has decreased to such a low value that very large amounts of water must be added to produce a small change in reactivity.

C. Boron concentration has become so low that very large amounts of water must be added to produce a small change in boron concentration.

D. The reactivity worth of the boron has increased so much that reactivity changes via boron dilution cannot be safely controlled by the operator.

QUESTION: 65

Which one of the following will be controlled by an operator to add positive reactivity when taking the reactor critical during a reactor startup?

A. RCS boron and control rods only

B. Control rods and moderator temperature only

C. Moderator temperature, RCS boron, and control rods

D. RCS flow, control rods, and moderator temperature

QUESTION: 66

A reactor startup is in progress and the reactor is slightly subcritical. Assuming the reactor remains subcritical, a short control rod (CEA) withdrawal will cause the reactor startup rate indication to increase rapidly in the positive direction, and then:

A. rapidly decrease and stabilize at a negative 1/3 dpm.

B. gradually decrease and stabilize at zero.

C. stabilize until the point of adding heat is reached; then decrease to zero.

D. continue a rapid increase until the point of adding heat is reached; then decrease to zero.

QUESTION: 67

During a reactor startup, the operator adds 1.0% ΔK/K of positive reactivity by withdrawing control rods (CEAs), thereby increasing equilibrium source range neutron level from 220 cps to 440 cps.

To raise equilibrium source range neutron level to 880 cps, an additional _____ of positive reactivity must be added.

A. 4.0% ΔK/K

B. 2.0% ΔK/K

C. 1.0% ΔK/K

D. 0.5% ΔK/K

QUESTION: 68

Which one of the following statements describes count rate characteristics after a 5 second control rod (CEA) withdrawal with the reactor very close to criticality? (Assume the reactor remains subcritical).

A. There will be no change in count rate until criticality is achieved.

B. The count rate will rapidly increase (prompt jump) to a stable higher value.

C. The count rate will rapidly increase (prompt jump) then gradually increase and stabilize at a higher value.

D. The count rate will rapidly increase (prompt jump) then gradually decrease and stabilize at the previous value.

QUESTION: 69

The following data were obtained during a reactor startup:

Rod Position (units withdrawn)	Count Rate (CPS)
0	20
10	25
15	29
20	33
25	40
30	50

Assuming uniform differential rod worth, at what rod height will criticality occur?

A. 35 to 45 units withdrawn

B. 46 to 55 units withdrawn

C. 56 to 65 units withdrawn

D. 66 to 75 units withdrawn

QUESTION: 70

An estimated critical rod position (ECP) has been calculated for a reactor startup to be performed 15 hours after a trip from 100% power equilibrium conditions. Which one of the following conditions would cause the actual critical rod position to be <u>higher</u> than the predicted critical rod position?

A. A 90% value for reactor power was used in the ECP calculation.

B. Reactor criticality is achieved approximately 2 hours earlier than anticipated.

C. Steam generator pressures are decreased by 100 psi just prior to criticality.

D. Current boron concentration is 10 ppm lower than the value used in the ECP calculation.

QUESTION: 71

With K_{eff} = 0.985, how much reactivity must be added to make the reactor <u>exactly</u> critical?

A. 1.54% $\Delta k/k$

B. 1.52% $\Delta k/k$

C. 1.50% $\Delta k/k$

D. 1.48% $\Delta k/k$

QUESTION: 72

A reactor is critical several decades below the point of adding heat (POAH) when a small amount of <u>positive</u> reactivity is added to the core. If the exact same amount of <u>negative</u> reactivity is again added to the core prior to reaching the POAH, reactor power will stabilize:

A. higher than the initial power level but below the POAH.

B. lower than the initial power level.

C. at the initial power level.

D. at the POAH.

QUESTION: 73

A pressure gauge on a condenser reads 27 inches of mercury (Hg) vacuum. What is the absolute pressure corresponding to this vacuum? (Assume an atmospheric pressure of 15 psia.)

A. 14.0 psia

B. 13.5 psia

C. 1.5 psia

D. 1.0 psia

QUESTION: 74

The plant is shutdown with the pressurizer in a saturated condition with liquid and vapor temperatures at 650°F. After an RCS cooldown, pressurizer conditions are as follows:

Pressurizer liquid temperature = 588°F
Pressurizer vapor temperature = 607°F
Pressurizer pressure = 1410 psia

Given these conditions, the pressurizer liquid is _____ and the pressurizer vapor is _____.

A. saturated; saturated

B. saturated; superheated

C. subcooled; saturated

D. subcooled; superheated

QUESTION: 75

Main condenser hotwell condensate is 4°F subcooled at a temperature of 112°F. What is the condenser pressure?

A. 1.78 psia

B. 1.51 psia

C. 1.35 psia

D. 1.20 psia

QUESTION: 76

Which one of the following changes will directly decrease condensate depression of the water in the main condenser hotwell?

A. Decreased main turbine generator Megawatt load

B. Decreased circulating water temperature

C. Increased circulating water flow

D. Increased vacuum in the main condenser

QUESTION: 77

The reactor coolant system is being maintained at 1000 psia. A pressurizer safety/relief valve is slowly discharging to a collection tank, which is maintained at 5 psig.

What is the enthalpy of the fluid entering the tank?

A. 1,210 BTU/lbm

B. 1,193 BTU/lbm

C. 1,178 BTU/lbm

D. 1,156 BTU/lbm

QUESTION: 78

Which one of the following changes will cause an <u>increase</u> in plant efficiency?

A. Decreasing the temperature of the water entering the steam generators.

B. Decreasing the superheat of the steam entering the low pressure turbines.

C. Decreasing the circulating water flow rate through the main condenser.

D. Decreasing the concentration of noncondensible gases in the main condenser.

QUESTION: 79

Which one of the following methods will increase the possibility and/or severity of water hammer?

A. Opening and closing system valves slowly.

B. Venting fluid systems prior to starting a pump

C. Starting a centrifugal pump with the discharge valve fully open.

D. Starting a centrifugal pump with the discharge valve fully closed.

QUESTION: 80

A centrifugal pump is being returned to service after maintenance. However, the operator fail to vent the pump.

When the pump is started the operator should see _____ flow rate and _____ discharge head with respect to normal operations.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 81

Which one of the following will <u>decrease</u> the head loss experienced in an operating cooling water system?

A. Shifting two heat exchangers from parallel to series operation.

B. Starting a second pump in parallel with the operating pump.

C. Replacing a 20 foot section of 10 inch diameter pipe with a 20 foot section of 12 inch diameter pipe.

D. Replacing a 10 foot section of 10 inch diameter pipe with a 20 foot section of 10 inch diameter pipe.

QUESTION: 82

A density-compensated flow instrument is being used to measure mass flow rate in a steam system. If the pressure of the steam decreases, <u>indicated</u> mass flow rate will: (Assume volumetric flow rate is constant.)

A. increase for all steam conditions.

B. decrease for all steam conditions.

C. increase, but only if the steam is saturated (not superheated).

D. decrease, but only if the steam is saturated (not superheated).

QUESTION: 83

While on surveillance rounds, an operator notices that a centrifugal pump is making a great deal of noise (like marbles rattling inside the pump casing) and the discharge pressure is fluctuating. This set of conditions indicates:

A. pump runout.

B. pump cavitation.

C. pump bearing deterioration.

D. pump packing deterioration.

QUESTION: 84

Excessive amounts of entrained gases passing through a single-phase (liquid) heat exchanger will reduce the overall heat transfer coefficient of the heat exchanger because:

A. the laminar layer thickness will decrease.

B. the specific heat capacity of the liquid will decrease.

C. the average ΔT across the heat exchanger tubes will decrease.

D. the thermal conductivity of the heat exchanger tubes will decrease.

QUESTION: 85

The fuel rods are normally charged with _____ gas to improve the heat transferred by _____ from the fuel pellets to the cladding.

A. nitrogen; conduction

B. nitrogen; convection

C. helium; conduction

D. helium; convection

QUESTION: 86

Which one of the following is an example of radiation heat transfer?

A. Heat transfer from the fuel cladding to the reactor coolant during stable film boiling.

B. Heat transfer from the center to the edge of a fuel pellet at end of core life.

C. Heat transfer from the reactor coolant to the feedwater in a steam generator.

D. Heat transfer from the fuel cladding to the reactor coolant via subcooled nucleate boiling.

QUESTION: 87

Why does nucleate boiling improve heat transfer in the core?

A. The formation of steam bubbles at nucleation sites on the fuel clad allows more heat to be transferred by conduction.

B. The formation of steam bubbles at nucleation sites on the fuel clad reduces coolant flow in that area and allows more heat to be transferred by convection.

C. Heat is removed from the fuel rod as both sensible heat and latent heat of condensation, and the heat is transferred directly to the coolant by radiative heat transfer.

D. Heat is removed from the fuel rod as both sensible heat and latent heat of vaporization, and the motion of the steam bubbles causes rapid mixing of the coolant.

QUESTION: 88

Which one of the following describes departure from nucleate boiling?

A. Steam bubbles begin to form on the surface of the fuel rod, causing an increase in the heat flux from the fuel rod.

B. Steam bubbles completely blanket the fuel rod, causing an exponential increase in the heat flux from the fuel rod.

C. Steam bubbles begin to blanket the fuel rod, causing a rapid increase in the ΔT between the fuel cladding and the coolant.

D. Steam bubbles begin to blanket the fuel rod, causing a rapid decrease in the ΔT between the fuel cladding and the coolant.

QUESTION: 89

Critical heat flux (CHF) is the heat transfer rate per unit _____ of fuel rod that will initially cause _____.

A. volume; nucleate boiling

B. area; nucleate boiling

C. volume; departure from nucleate boiling

D. area; departure from nucleate boiling

QUESTION: 90

The reactor is operating at 100% steady state power at end of core life with all control rods (CEAs) fully withdrawn. At what axial location in a typical fuel assembly will the minimum departure from nucleate boiling ratio (DNBR) occur?

A. At the bottom of the fuel assembly

B. At the top of the fuel assembly

C. Between the bottom and midplane of the fuel assembly

D. Between the midplane and the top of the fuel assembly

QUESTION: 91

Core heat transfer is maximized by the presence of:

A. turbulent flow with no nucleate boiling.

B. laminar flow with no nucleate boiling.

C. turbulent flow with nucleate boiling.

D. laminar flow with nucleate boiling.

QUESTION: 92

Which one of the following will directly increase the reactor coolant subcooling margin with the reactor operating at full power?

A. Decrease RCS hot leg temperature

B. Decrease RCS cold leg temperature

C. Increase the concentration of soluble gases in the RCS

D. Increase coolant flow rate

QUESTION: 93

Fully-developed natural circulation flow rate will be greatest when:

A. all reactor coolant pumps stop sequentially within 1 hour after a reactor trip.

B. all reactor coolant pumps stop at the same time the reactor trips.

C. all reactor coolant pumps run for 1 hour after a reactor trip, and then stop.

D. only one reactor coolant pump runs for 1 hour after a reactor trip, and then stops.

QUESTION: 94

Fuel cladding integrity is ensured by:

A. always operating below 110% of RCS design pressure.

B. ensuring the departure from nucleate boiling ratio (DNBR) is always greater than 1.0.

C. ensuring operation above the critical heat flux during all operating conditions.

D. actuation of the Reactor Protection System upon a reactor accident.

QUESTION: 95

The 2200°F maximum peak fuel cladding temperature limit is imposed because:

A. it is approximately 500°F below the fuel cladding melting temperature.

B. the oxidation rate of the zircaloy fuel cladding increases sharply above 2200°F.

C. any cladding temperature higher than this correlates to a fuel centerline temperature above the fuel melting point.

D. the thermal conductivity of zircaloy decreases at temperatures above 2200°F causing an unacceptably sharp rise in the fuel centerline temperature.

QUESTION: 96

The nil-ductility transition temperature is that temperature:

A. below which vessel failure is imminent.

B. above which vessel failure is imminent.

C. below which the probability of brittle fracture significantly increases.

D. above which the probability of brittle fracture significantly increases.

QUESTION: 97

Stress on the reactor vessel inner wall is greater during cooldown than heatup because:

A. heatup stress totally offsets pressure stress at the inner wall.

B. both pressure stress and cooldown stress are tensile at the inner wall.

C. cooldown stress and heatup stress are both tensile at the inner wall, but cooldown stress is greater in magnitude.

D. the tensile cooldown stress at the inner wall is greater in magnitude than the compressive pressure stress at the same location.

QUESTION: 98

Prolonged exposure to _____ will cause nil-ductility transition temperature of the reactor vessel to _____?

A. neutron radiation; increase

B. neutron radiation; decrease

C. boric acid; increase

D. boric acid; decrease

QUESTION: 99

The plant is shutdown with the RCS at 1200 psia and 350°F. Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

A. A rapid heatup followed by a rapid pressurization.

B. A rapid cooldown followed by a rapid pressurization.

C. A rapid depressurization followed by a rapid heatup.

D. A rapid depressurization followed by a rapid cooldown.

QUESTION: 100

An uncontrolled cooldown is a brittle fracture concern because it creates a large _____ stress at the _____ wall of the reactor vessel.

A. compressive; inner

B. tensile; inner

C. compressive; outer

D. tensile; outer

UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 1992 - FORM B

Please Print:

Name: _____

Facility: _____

ID Number: _____

Start Time: _____ Stop Time: _____

INSTRUCTIONS TO CANDIDATE

Use the answer sheet provided. Each question has equal point value. A score of at least 80% is required to pass this portion of the written licensing examination. All examination papers will be collected 2.5 hours after the examination starts.

SECTION	QUESTIONS	% OF TOTAL	SCORE
THERMODYNAMICS	1 - 28		
COMPONENTS	29 - 72		
REACTOR THEORY	73 - 100		
TOTALS	100		

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

_____
Candidate's Signature

RULES AND GUIDELINES FOR THE GENERIC FUNDAMENTALS EXAMINATION

During the administration of this examination the following rules apply:

1. Print your name in the blank provided on the cover sheet of the examination.

2. Fill in the name of your facility.

3. Fill in the ID Number you were given at registration.

4. Fill in your start and stop times at the appropriate time.

5. Two aids are provided for your use during the examination:

   (1) An equations and conversions sheet contained within the examination copy, and

   (2) Steam tables provided by your proctor.

6. Use only the answer sheet provided. Credit will only be given for answers properly marked on this sheet. Follow the instructions for filling out the answer sheet.

7. Scrap paper will be provided for calculations.

8. Cheating on the examination will result in the automatic forfeiture of this examination. Cheating could also result in severe penalties.

9. Restroom trips are limited. Only **ONE** examinee may leave the room at a time. In order to avoid the appearance or possibility of cheating, avoid all contact with anyone outside of the examination room.

10. After you have completed the examination, sign the statement on the cover sheet indicating that the work is your own and you have not received or been given any assistance in completing the examination.

11. Turn in your examination materials, answer sheet on top, followed by the examination booklet, then examination aids - steam table booklets, handouts and scrap paper used during the examination.

12. After turning in your examination materials, leave the examination area, as defined by the proctor. If after leaving you are found in the examination area while the examination is in progress, your examination may be forfeited.

GENERIC FUNDAMENTALS EXAMINATIONS SECTION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

$\dot{Q} = \dot{m}c_p\Delta T$

$\dot{Q} = \dot{m}\Delta h$

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

$SUR = 26.06/\tau$

$SUR = \dfrac{26.06(\lambda_{eff}\rho)}{(\beta - \rho)}$

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

$P = P_o e^{(t/\tau)}$

$\tau = (l^*/\rho) + [(\bar{\beta} - \rho)/\lambda_{eff}\rho]$

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

$\rho = \Delta K_{eff}/K_{eff}$

$$\upsilon(P_e - P_i) + \frac{(\bar{V}_e^2 - \bar{V}_i^2)}{2} + g(z_e - z_i) = 0$$

$$\text{Cycle Efficiency} = \frac{\text{Net Work (out)}}{\text{Energy (in)}}$$

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

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = \dfrac{(1 - K_{eff})_0}{(1 - K_{eff})_1}$

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

$Pwr = W_f\dot{m}$

$\tau = l^*/(\rho - \bar{\beta})$

$l^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1$ seconds^{-1}

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 BTU	=	778 ft-lbf	°F	=	9/5 °C + 32
°C	=	5/9(°F - 32)			

QUESTION: 1

A pressure gauge on a condenser reads 27 inches of mercury (Hg) vacuum. What is the absolute pressure corresponding to this vacuum? (Assume an atmospheric pressure of 15 psia.)

A. 14.0 psia

B. 13.5 psia

C. 1.5 psia

D. 1.0 psia

QUESTION: 2

The plant is shutdown with the pressurizer in a saturated condition with liquid and vapor temperatures at 650°F. After an RCS cooldown, pressurizer conditions are as follows:

Pressurizer liquid temperature = 588°F
Pressurizer vapor temperature = 607°F
Pressurizer pressure = 1410 psia

Given these conditions, the pressurizer liquid is _____ and the pressurizer vapor is _____.

A. saturated; saturated

B. saturated; superheated

C. subcooled; saturated

D. subcooled; superheated

QUESTION: 3

Main condenser hotwell condensate is 4°F subcooled at a temperature of 112°F. What is the condenser pressure?

A. 1.78 psia

B. 1.51 psia

C. 1.35 psia

D. 1.20 psia

QUESTION: 4

Which one of the following changes will directly decrease condensate depression of the water in the main condenser hotwell?

A. Decreased main turbine generator Megawatt load

B. Decreased circulating water temperature

C. Increased circulating water flow

D. Increased vacuum in the main condenser

QUESTION: 5

The reactor coolant system is being maintained at 1000 psia. A pressurizer safety/relief valve is slowly discharging to a collection tank, which is maintained at 5 psig.

What is the enthalpy of the fluid entering the tank?

A. 1,200 BTU/lbm

B. 1,193 BTU/lbm

C. 1,178 BTU/lbm

D. 1,156 BTU/lbm

QUESTION: 6

Which one of the following changes will cause an <u>increase</u> in plant efficiency?

A. Decreasing the temperature of the water entering the steam generators.

B. Decreasing the superheat of the steam entering the low pressure turbines.

C. Decreasing the circulating water flow rate through the main condenser.

D. Decreasing the concentration of noncondensible gases in the main condenser.

QUESTION: 7

Which one of the following methods will increase the possibility and/or severity of water hammer?

A. Opening and closing system valves slowly.

B. Venting fluid systems prior to starting a pump.

C. Starting a centrifugal pump with the discharge valve fully open.

D. Starting a centrifugal pump with the discharge valve fully closed.

QUESTION: 8

A centrifugal pump is being returned to service after maintenance. However, the operator fail to vent the pump.

When the pump is started the operator should see _____ flow rate and _____ discharge head with respect to normal operations.

A. higher; lower

B. higher; higher

C. lower; lower

D. lower; higher

QUESTION: 9

Which one of the following will decrease the head loss experienced in an operating cooling water system?

A. Shifting two heat exchangers from parallel to series operation.

B. Starting a second pump in parallel with the operating pump.

C. Replacing a 20 foot section of 10 inch diameter pipe with a 20 foot section of 12 inch diameter pipe.

D. Replacing a 10 foot section of 10 inch diameter pipe with a 20 foot section of 10 inch diameter pipe.

QUESTION: 10

A density-compensated flow instrument is being used to measure mass flow rate in a steam system. If the pressure of the steam decreases, indicated mass flow rate will: (Assume volumetric flow rate is constant.)

A. increase for all steam conditions.

B. decrease for all steam conditions.

C. increase, but only if the steam is saturated (not superheated).

D. decrease, but only if the steam is saturated (not superheated).

QUESTION: 11

While on surveillance rounds, an operator notices that a centrifugal pump is making a great deal of noise (like marbles rattling inside the pump casing) and the discharge pressure is fluctuating. This set of conditions indicates:

A. pump runout.

B. pump cavitation.

C. pump bearing deterioration.

D. pump packing deterioration.

QUESTION: 12

Excessive amounts of entrained gases passing through a single-phase (liquid) heat exchanger will reduce the overall heat transfer coefficient of the heat exchanger because:

A. the laminar layer thickness will decrease.

B. the specific heat capacity of the liquid will decrease.

C. the average ΔT across the heat exchanger tubes will decrease.

D. the thermal conductivity of the heat exchanger tubes will decrease.

QUESTION: 13

The fuel rods are normally charged with _____ gas to improve the heat transferred by _____ from the fuel pellets to the cladding.

A. nitrogen; conduction

B. nitrogen; convection

C. helium; conduction

D. helium; convection

QUESTION: 14

Which one of the following is an example of radiation heat transfer?

A. Heat transfer from the fuel cladding to the reactor coolant during stable film boiling.

B. Heat transfer from the center to the edge of a fuel pellet at end of core life.

C. Heat transfer from the reactor coolant to the feedwater in a steam generator.

D. Heat transfer from the fuel cladding to the reactor coolant via subcooled nucleate boiling.

QUESTION: 15

Why does nucleate boiling improve heat transfer in the core?

A. The formation of steam bubbles at nucleation sites on the fuel clad allows more heat to be transferred by conduction.

B. The formation of steam bubbles at nucleation sites on the fuel clad reduces coolant flow in that area and allows more heat to be transferred by convection.

C. Heat is removed from the fuel rod as both sensible heat and latent heat of condensation, and the heat is transferred directly to the coolant by radiative heat transfer.

D. Heat is removed from the fuel rod as both sensible heat and latent heat of vaporization, and the motion of the steam bubbles causes rapid mixing of the coolant.

QUESTION: 16

Which one of the following describes departure from nucleate boiling?

A. Steam bubbles begin to form on the surface of the fuel rod, causing an increase in the heat flux from the fuel rod.

B. Steam bubbles completely blanket the fuel rod, causing an exponential increase in the heat flux from the fuel rod.

C. Steam bubbles begin to blanket the fuel rod, causing a rapid increase in the ΔT between the fuel cladding and the coolant.

D. Steam bubbles begin to blanket the fuel rod, causing a rapid decrease in the ΔT between the fuel cladding and the coolant.

QUESTION: 17

Critical heat flux (CHF) is the heat transfer rate per unit _____ of fuel rod that will initially cause _____.

A. volume; nucleate boiling

B. area; nucleate boiling

C. volume; departure from nucleate boiling

D. area; departure from nucleate boiling

QUESTION: 18

The reactor is operating at 100% steady state power at end of core life with all control rods (CEAs) fully withdrawn. At what axial location in a typical fuel assembly will the minimum departure from nucleate boiling ratio (DNBR) occur?

A. At the bottom of the fuel assembly

B. At the top of the fuel assembly

C. Between the bottom and midplane of the fuel assembly

D. Between the midplane and the top of the fuel assembly

QUESTION: 19

Core heat transfer is maximized by the presence of:

A. turbulent flow with no nucleate boiling.

B. laminar flow with no nucleate boiling.

C. turbulent flow with nucleate boiling.

D. laminar flow with nucleate boiling.

QUESTION: 20

Which one of the following will directly increas. the reactor coolant subcooling margin with the reactor operating at full power?

A. Decrease RCS hot leg temperature

B. Decrease RCS cold leg temperature

C. Increase the concentration of soluble gases in the RCS

D. Increase coolant flow rate

QUESTION: 21

Fully-developed natural circulation flow rate will be greatest when:

A. all reactor coolant pumps stop sequentially within 1 hour after a reactor trip.

B. all reactor coolant pumps stop at the same time the reactor trips.

C. all reactor coolant pumps run for 1 hour after a reactor trip, and then stop.

D. only one reactor coolant pump runs for 1 hour after a reactor trip, and then stops.

QUESTION: 22

Fuel cladding integrity is ensured by:

A. always operating below 110% of RCS design pressure.

B. ensuring the departure from nucleate boiling ratio (DNBR) is always greater than 1.0.

C. ensuring operation above the critical heat flux during all operating conditions.

D. actuation of the Reactor Protection System upon a reactor accident.

QUESTION: 23

The 2200°F maximum peak fuel cladding temperature limit is imposed because:

A. it is approximately 500°F below the fuel cladding melting temperature.

B. the oxidation rate of the zircaloy fuel cladding increases sharply above 2200°F.

C. any cladding temperature higher than this correlates to a fuel centerline temperature above the fuel melting point.

D. the thermal conductivity of zircaloy decreases at temperatures above 2200°F causing an unacceptably sharp rise in the fuel centerline temperature.

QUESTION: 24

The nil-ductility transition temperature is that temperature:

A. below which vessel failure is imminent.

B. above which vessel failure is imminent.

C. below which the probability of brittle fracture significantly increases.

D. above which the probability of brittle fracture significantly increases.

QUESTION: 25

Stress on the reactor vessel inner wall is greater during cooldown than heatup because:

A. heatup stress totally offsets pressure stress at the inner wall.

B. both pressure stress and cooldown stress are tensile at the inner wall.

C. cooldown stress and heatup stress are both tensile at the inner wall, but cooldown stress is greater in magnitude.

D. the tensile cooldown stress at the inner wall is greater in magnitude than the compressive pressure stress at the same location.

QUESTION: 26

Prolonged exposure to _____ will cause nil-ductility transition temperature of the reactor vessel to _____?

A. neutron radiation; increase

B. neutron radiation; decrease

C. boric acid; increase

D. boric acid; decrease

QUESTION: 27

The plant is shutdown with the RCS at 1200 psia and 350°F. Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

A. A rapid heatup followed by a rapid pressurization.

B. A rapid cooldown followed by a rapid pressurization.

C. A rapid depressurization followed by a rapid heatup.

D. A rapid depressurization followed by a rapid cooldown.

QUESTION: 28

An uncontrolled cooldown is a brittle fracture concern because it creates a large _____ stress at the _____ wall of the reactor vessel.

A. compressive; inner

B. tensile; inner

C. compressive; outer

D. tensile; outer

QUESTION: 29

Which one of the following valves provides overpressure protection to limit the internal pressure in vessels and thus protect personnel and equipment?

A. Safety

B. Control

C. Sentinel

D. Pressure regulating

QUESTION: 30

Refer to the drawing of a hydraulically-operated valve that is shown in a throttled position (see figure on next page).

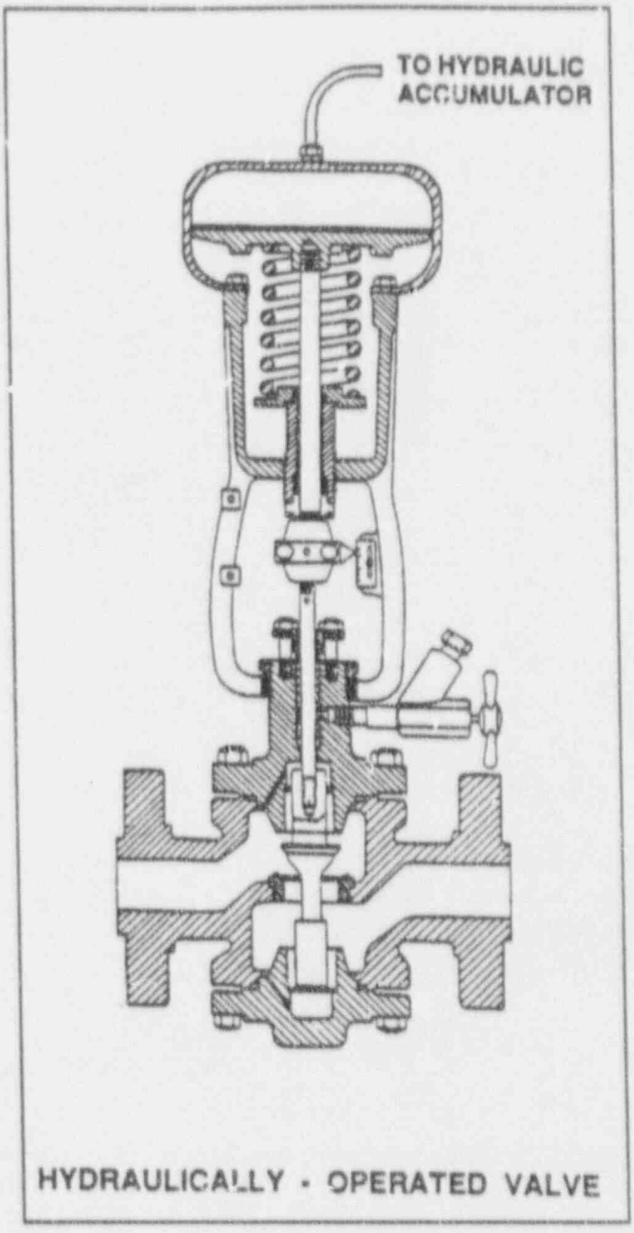
Select the position of this valve following a loss of hydraulic fluid pressure.

A. Fully open

B. As is

C. Fully closed

D. Mid-position



HYDRAULICALLY - OPERATED VALVE

QUESTION: 31

An operator attempts to close a fully-open manual gate valve to isolate a pump in a cooling water system that has been cooled down for maintenance. However, the operator is unable to manually rotate the handwheel in the close direction.

Which one of the following could cause this condition?

A. A hydraulic lock has developed under the valve disk.

B. A hydraulic lock has developed in the valve bonnet between the valve disk and its backseat.

C. The two halves of the valve disk have expanded and are jammed against the valve seats.

D. The valve disk has jammed against its backseat by the difference in the thermal contraction of the stem and the bonnet.

QUESTION: 32

To verify a manual valve in an operating system is <u>closed</u>, the operator should operate the valve handwheel in the:

A. open direction until the valve is fully open, then close it using normal force.

B. open direction until flow sounds are heard, then close the valve using normal force.

C. close direction using normal force and verify there is no substantial handwheel movement.

D. close direction until it stops, then close it an additional one-half turn using additional force if necessary.

QUESTION: 33

A liquid flow rate detector was installed with its low-pressure sensing line filled with air and its high-pressure sensing line filled with water. If the detector is placed in service in an operating system, indicated flow rate will be:

A. zero.

B. equal to actual flow rate but greater than zero.

C. lower than actual flow rate.

D. higher than actual flow rate.

QUESTION: 34

Which one of the following will cause indicated volumetric flow rate to be lower than actual volumetric flow rate using a differential pressure flow detector that is connected to a calibrated orifice?

A. System pressure decreases.

B. The orifice erodes over time.

C. Debris becomes lodged in the orifice.

D. A leak develops in the low pressure sensing line.

QUESTION: 35

A differential (D/P) detector is being used to measure main steam flow rate. At a steam flow rate of 5×10^6 lbm/hr measured D/P is 40 psid.

If steam flow changes such that current D/P is 30 psid, what is the current steam flow rate?

A. 2.11×10^6 lbm/hr

B. 3.54×10^6 lbm/hr

C. 3.75×10^6 lbm/hr

D. 4.33×10^6 lbm/hr

QUESTION: 36

Which one of the following flow devices produces the largest unrecoverable head loss when used in an operating fluid system?

A. Venturi

B. Flow nozzle

C. Pipe elbow

D. Orifice

QUESTION: 37

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

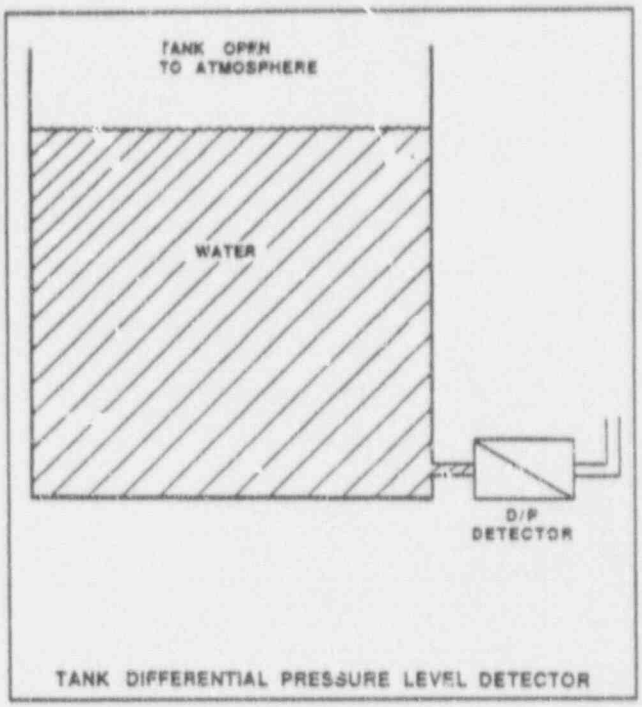
The associated level instrument was calibrated with the water in the tank at 100°F. If mass in the tank remains constant and the water temperature increases to 120°F, the <u>indicated</u> level will:

A. increase in direct proportion to the temperature rise.

B. increase but remain less than actual level.

C. decrease in direct proportion to the temperature rise.

D. remain the same although actual level increases.



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 38

Refer to the drawing of a tank differential pressure (D/P) level detector (see figure below).

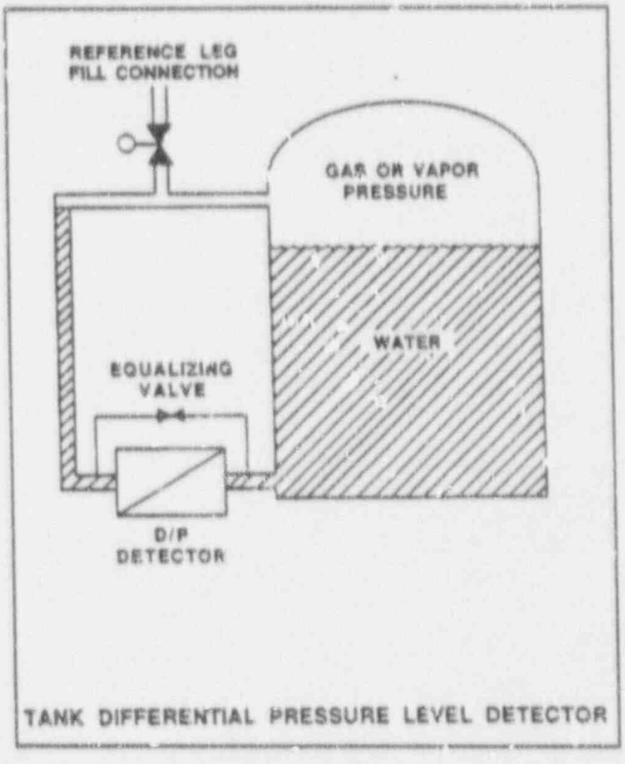
The D/P sensed by the detector is _____ proportional to the temperature of the water in the tank if _____ is constant.

A. directly; level

B. inversely; level

C. directly; mass

D. inversely; mass



TANK DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 39

Refer to the drawing of a steam generator differential pressure level detector (see figure below).

With the reactor shutdown, steam generator (S/G) pressures are inadvertently decreased from 900 psig to 700 psig in 5 minutes due to operator error.

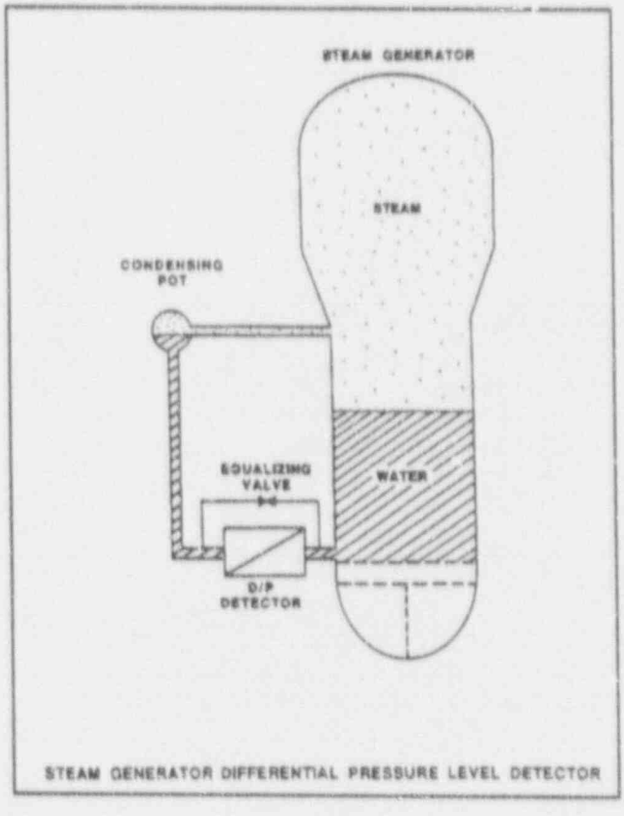
After the S/G pressures stabilize, indicated S/G level will be _____ than actual level if reference leg flashing occurs, and after the condensing pot refills, indicated level will _____.

A. higher; stabilize above actual level

B. lower; stabilize below actual level

C. higher; decrease and stabilize near the actual level

D. lower; increase and stabilize near the actual level



STEAM GENERATOR DIFFERENTIAL PRESSURE LEVEL DETECTOR

QUESTION: 40

A simple bellows pressure detector is located in the reactor containment with its low pressure side vented to the containment. If a main steam break raises containment pressure by 40 psig, the associated pressure indication (disregarding any temperature effect on the bellows) will:

A. increase by 40 psig.

B. decrease by 40 psig.

C. increase by the square root of 40 psig.

D. decrease by the square root of 40 psig.

QUESTION: 41

If shorting occurs within a resistance temperature detector (RTD), indication will fail:

A. low.

B. high.

C. as is.

D. to midscale.

QUESTION: 42

Which one of the following is commonly used as a coating on the inner surface of a fission chamber for the purpose of neutron detection?

A. U_3O_8 coating of natural enrichment on both electrode surfaces

B. U_3O_8 coating with highly enriched U-235 on both electrode surfaces

C. U_3O_8 coating of natural enrichment on the inner surface of the chamber

D. U_3O_8 coating of highly enriched U-235 on the inner surface of the chamber

QUESTION: 43

In an automatic flow controller, the range of values around the setpoint of a measured variable where no action occurs is called:

A. bias.

B. error.

C. deadband.

D. deviation.

QUESTION: 44

An emergency diesel generator (D/G) is the only power source connected to its emergency bus. The governor of the D/G directly senses D/G _____ and directly adjusts D/G _____ flow to maintain a relatively constant D/G frequency.

A. load; air

B. load; fuel

C. speed; air

D. speed; fuel

QUESTION: 45

Which one of the following describes the response of a direct-acting derivative controller, operating in automatic, to an increase in the controlled parameter above the controller setpoint?

A. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller setpoint, at which time the output signal becomes constant.

B. The controller will develop an output signal that will remain directly proportional to the difference between the controlled parameter and the controller setpoint.

C. The controller will develop an output signal that continues to increase until the controlled parameter equals the controller setpoint, at which time the output signal becomes zero.

D. The controller will develop an output signal that will remain directly proportional to the rate of change of the controlled parameter.

QUESTION: 46

In a proportional controller, the term "offset" refers to the difference between the:

A. control point and setpoint.

B. control point and proportional band.

C. deadband and setpoint.

D. deadband and proportional band.

QUESTION: 47

What precaution must be observed when transferring a valve controller from the automatic mode to the manual mode of control?

A. Ensure that a substantial deviation is established between the automatic mode and the manual mode.

B. Ensure that the valve controller output signals are matched between the automatic mode and the manual mode.

C. Ensure that the automatic valve controller signal is increasing before transferring to the manual mode of control.

D. Ensure that the automatic valve controller signal is decreasing before transferring to the manual mode of control.

QUESTION: 48

Which one of the following is <u>not</u> a normal indication of a gas/vapor bound motor-operated centrifugal pump that is operating in a cooling water system?

A. Fluctuating pump discharge pressure

B. Reduced system flow rate

C. Increased pump motor current

D. Increased pump noise level

QUESTION: 49

When a centrifugal pump is operating at shutoff head, it is pumping at _____ capacity and _____ discharge head.

A. maximum; minimum

B. maximum; maximum

C. minimum; minimum

D. minimum; maximum

QUESTION: 50

The available net positive suction head for a pump may be expressed as:

A. suction pressure minus saturation pressure of the fluid being pumped.

B. suction pressure plus discharge pressure.

C. discharge pressure minus saturation pressure of the fluid being pumped.

D. discharge pressure minus suction pressure.

QUESTION: 51

A centrifugal pump is operating in a closed system with all valves fully open. If the pump discharge valve is throttled 75% closed, pump motor current will:

A. increase and stabilize at a higher value.

B. decrease and stabilize at a lower value.

C. increase briefly, then return to original value.

D. decrease briefly, then return to original value.

QUESTION: 52

Which one of the following is an indication of pump runout?

A. Low pump flow rate

B. High pump vibration

C. Low pump motor current

D. High pump discharge pressure

QUESTION: 53

A variable-speed positive displacement pump is operating at 100 rpm with a flow rate of 60 gpm in an open system. To decrease pump flow rate to 30 gpm, pump speed must be decreased to approximately:

A. 25 rpm.

B. 35 rpm.

C. 50 rpm.

D. 71 rpm.

QUESTION: 54

Refer to the drawing of four sets of centrifugal pump operating curves (see figure below). Each set of curves shows the combination of two pump/system operating conditions.

Two identical constant-speed centrifugal pumps are operating in series in an open system when one pump trips.

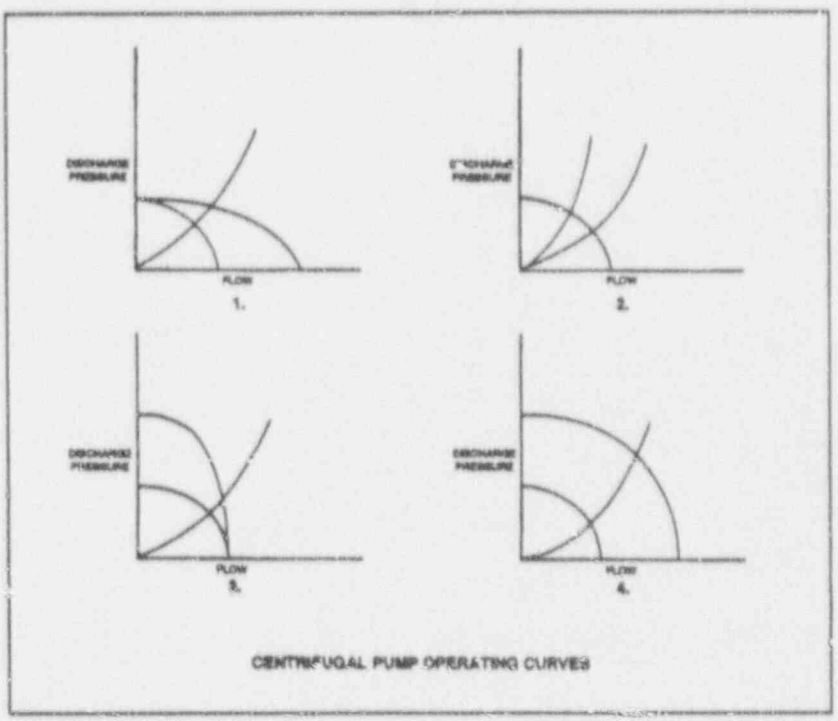
Which set of operating curves depicts the "before" and "after" conditions described above?

A. 1.

B. 2.

C. 3.

D. 4.



CENTRIFUGAL PUMP OPERATING CURVES

QUESTION: 55

Which one of the following is not an indication of a locked reactor coolant pump rotor?

A. Low reactor coolant system flow trip

B. Decreased flow rate in unaffected loop(s)

C. Reactor coolant system pressure transient

D. Increased reactor coolant pump amps with possible breaker trip

QUESTION: 56

A main generator is operating in parallel with the power grid. If the voltage supplied to the generator field is slowly and continuously decreased, the generator will experience high current due to: (Assume no generator protective actuations occur.)

A. excessive generator Mwe.

B. excessive generator KVAR (lagging).

C. excessive generator KVAR (leading).

D. generator reverse power.

QUESTION: 57

A centrifugal pump is operating with the following parameters:

Speed	= 1,800 rpm
Current	= 40 amperes
Pump Head	= 20 psi
Pump Flow Rate	= 400 gpm

What will be the new value of pump head and current if the speed is increased to 2,000 rpm?

A. 22 psi, 49 amps

B. 22 psi, 55 amps

C. 25 psi, 49 amps

D. 25 psi, 55 amps

QUESTION: 58

The starting current in an AC induction motor is much higher than the full-load running current because:

A. the rotor does not develop maximum induced current flow until it has achieved synchronous speed.

B. resistance is added to the electrical circuit after motor start to limit running current.

C. the stator is essentially a short circuit until a voltage is developed in the rotor.

D. a large amount of electrical power is required to initially establish a rotating magnetic field.

QUESTION: 59

The frequency of large AC motor starts should be limited to prevent excessive:

A. wear of motor thrust bearings.

B. heat buildup within the motor windings.

C. torsional stresses on the motor shaft.

D. arcing and degradation of motor breaker contacts.

QUESTION: 60

Whenever possible, a heat exchanger should be placed in service by introducing both fluids gradually and simultaneously to:

A. maximize the heat transferred across the heat exchanger tubes.

B. minimize boiling of the cooling water in the heat exchanger tubes.

C. provide maximum temperature control of the system being cooled.

D. prevent excessive thermal stresses in the heat exchanger.

QUESTION: 61

Refer to the drawing of a lube oil heat exchanger (see figure below).

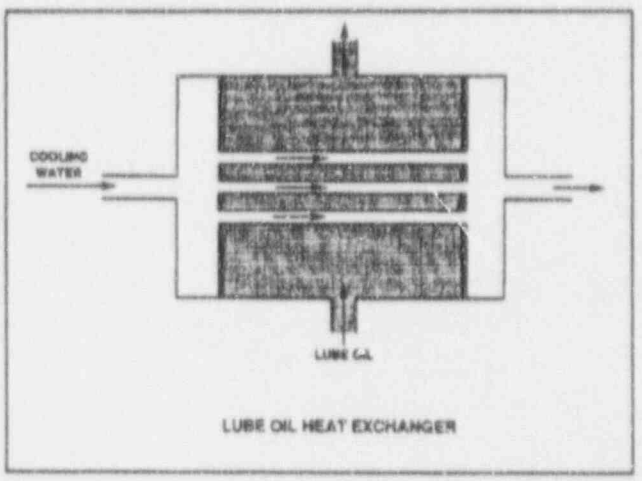
If scaling occurs inside the cooling water tubes, cooling water outlet temperature will _____ and oil outlet temperature will _____. (Assume oil and cooling water flow rates remain the same.)

A. decrease; decrease

B. decrease; increase

C. increase; decrease

D. increase; increase



QUESTION: 62

Refer to the drawing of an operating cooling water system (see figure below).

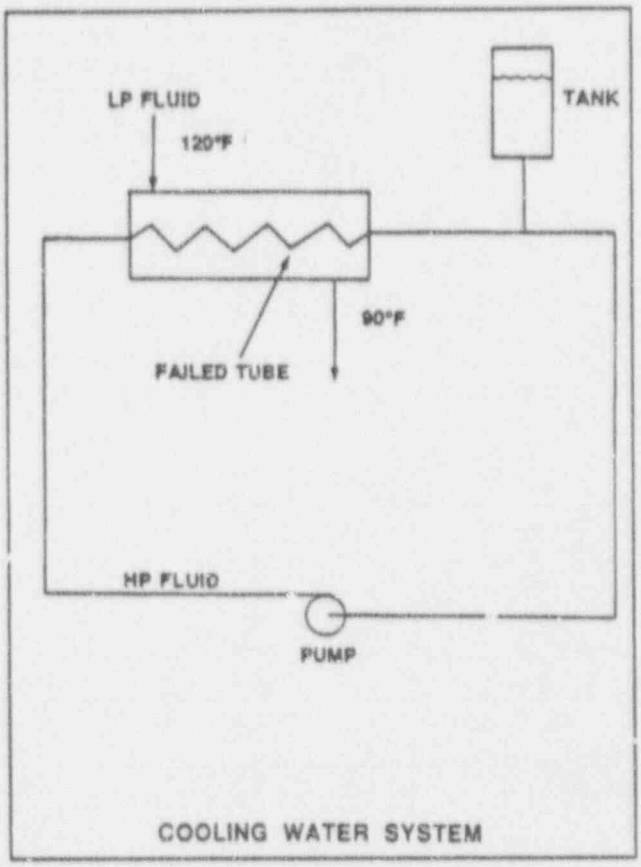
Which one of the following effects would occur as a result of a tube failure in the heat exchanger?

A. Level in the tank increases.

B. Flow in the low pressure system reverses.

C. Pressure in the low pressure system decreases.

D. LP fluid heat exchanger outlet temperature decreases.



QUESTION: 63

A demineralizer is being used in a water purification system. How will the accumulation of suspended solids in the demineralizer affect performance of the demineralizer?

A. The rate of unwanted ion removal from the system will decrease.

B. The flow rate of water through the demineralizer will increase.

C. The number of ion exchange sites will decrease.

D. The rate of resin depletion will increase.

QUESTION: 64

The ion exchange efficiency of a condensate demineralizer is maintained by performing a calculation using the:

A. change in pH at the outlet of the demineralizer over a period of time.

B. change in conductivity at the outlet of the demineralizer over a period of time.

C. demineralizer inlet and outlet pH.

D. demineralizer inlet and outlet conductivity.

QUESTION: 65

The plant is operating at 70% equilibrium power level when the temperature of reactor coolant letdown passing through a boron-saturated mixed bed ion exchanger is <u>decreased</u> by 20°F.

As a result, the boron concentration in the effluent of the ion exchanger will _____ because the affinity of the ion exchanger for boron atoms has _____.

A. increase; decreased

B. increase; increased

C. decrease; decreased

D. decrease; increased

QUESTION: 66

Which one of the following functions or capabilities would remain following a loss of control power to a typical 480 VAC bus feeder breaker?

A. Remote breaker control capability

B. Breaker closing spring automatic recharging capability

C. Remote bus voltage indication

D. Remote breaker position indication

QUESTION: 67

Which one of the following available local circuit breaker indications will provide the most reliable and positive indication that a bus feeder breaker is open? (Assume the following indications and mechanisms are operating properly.)

A. Load-side ammeter and overcurrent trip flags

B. Load-side ammeter and load-side voltage

C. OPEN/CLOSED mechanical flag indication and load-side voltage

D. OPEN/CLOSED mechanical flag indication and overcurrent trip flags

QUESTION: 68

Under which one of the following preexisting conditions will closing a circuit breaker between two electrical generators cause a sudden large and possibly damaging mechanical torque to be exerted on both of the generators?

A. One generator is supplying a 3% higher voltage than the other.

B. One generator is supplying a 3% higher frequency than the other.

C. The voltage of one generator is out of phase with the other.

D. The capacity of one generator is twice that of the other generator.

QUESTION: 69

Refer to the drawing of a typical valve control circuit (see figure below).

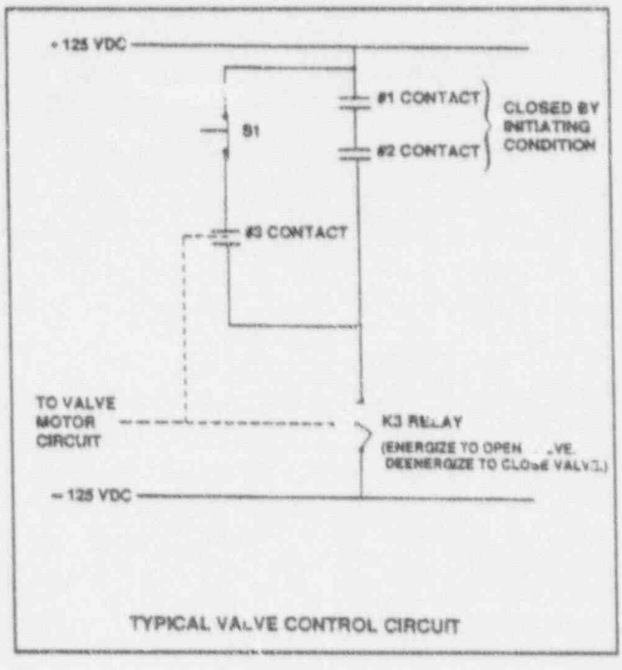
Which one of the following describes the function of the #3 contact?

A. To keep the K-3 relay energized after the initiating condition clears.

B. To provide a method for manually energizing the K-3 relay.

C. To increase circuit reliability as any one of three contacts can energize the K-3 relay.

D. To ensure the K-3 relay can always be de-energized even with the initiating condition present.



TYPICAL VALVE CONTROL CIRCUIT

QUESTION: 70

Closing the output breaker of the main generator with the frequency of the generator higher than grid frequency will result in the generator:

A. picking up a portion of the grid reactive load (MVAR).

B. picking up a portion of the grid real load (MWe).

C. behaving as a reactive load to the grid.

D. behaving as a real load to the grid.

QUESTION: 71

The function of high voltage electrical disconnects is to isolate equipment electrically during _____ conditions.

A. overcurrent

B. undervoltage

C. no-load

D. all normal and abnormal

QUESTION: 72

The following indications are observed for a motor breaker in the control room:

Red position indicating light - OFF
Green position indicating light - OFF
Load amps indicate normal load current

Assuming one of the indicating lights is burned out, what is the condition of the breaker?

A. Shut and racked in

B. Open and racked in

C. Shut and racked to "test" position

D. Open and racked to "test" position

QUESTION: 73

A thermal neutron exists at an energy _____ the epithermal range and its cross section for absorption in U-235 _____ as the neutron energy decreases.

A. above; decreases

B. above; increases

C. below; decreases

D. below; increases

QUESTION: 74

Which one of the following combinations of critical core conditions indicates the most excess reactivity exists in the core?

	CONTROL ROD (CEA) POSITION	RCS BORON CONCENTRATION
A.	25% inserted	500 ppm
B.	50% inserted	500 ppm
C.	25% inserted	1000 ppm
D.	50% inserted	1000 ppm

QUESTION: 75

A reactor at end of life has been shutdown from 100% power and cooled down to 140°F over 3 days. During the cooldown, Boron concentration was increased by 100 ppm. Given the following absolute values of reactivities added during the cooldown, assign a (+) or (-) as appropriate and choose the current value of shutdown margin.

Control Rods (CEAs)	= ( )	6.918% ΔK/K
Xenon	= ( )	2.675% ΔK/K
Power Defect	= ( )	1.575% ΔK/K
Boron	= ( )	1.040% ΔK/K
Temperature	= ( )	0.500% ΔK/K

A. -8.558% ΔK/K

B. -6.358% ΔK/K

C. -3.208% ΔK/K

D. -1.128% ΔK/K

QUESTION: 76

Over core life, plutonium isotopes are produced with delayed neutron fractions that are _____ than uranium delayed neutron fractions, thereby causing reactor power transients to be _____ near the end of core life.

A. larger; slower

B. larger; faster

C. smaller; slower

D. smaller; faster

QUESTION: 77

A reactor is operating at 75% power with the following conditions:

Power defect	=	-0.0157 ΔK/K
Shutdown margin	=	0.0241 ΔK/K
Effective delayed neutron fraction	=	0.0058
Effective prompt neutron fraction	=	0.9942

How much positive reactivity must be added to take the reactor "prompt critical"?

A. 0.0157 ΔK/K

B. 0.0241 ΔK/K

C. 0.0058 ΔK/K

D. 0.9942 ΔK/K

QUESTION: 78

Under which one of the following conditions is a reactor core most likely to have a <u>positive</u> moderator temperature coefficient?

A. Low coolant temperature at beginning-of-life

B. Low coolant temperature at end-of-life

C. High coolant temperature at beginning-of-life

D. High coolant temperature at end-of-life

QUESTION: 79

During an RCS cooldown, positive reactivity is added to the core (assuming a negative moderator temperature coefficient). This is partially due to:

A. a decrease in the thermal utilization factor.

B. an increase in the thermal utilization factor.

C. a decrease in the resonance escape probability.

D. an increase in the resonance escape probability.

QUESTION: 80

The amount of boric acid required to increase the coolant boron concentration by 50 ppm at BOL conditions (1200 ppm) is approximately _____ as the amount of boric acid required to increase boron concentration by 50 ppm at EOL (100 ppm).

A. the same

B. four times as large

C. eight times as large

D. twelve times as large

QUESTION: 81

Given the following initial parameters:

Total power coefficient	= -0.016% Δk/k/percent
Boron worth	= -0.010% Δk/k/ppm
Rod worth	= -0.030% Δk/k/inch
Initial RCS boron concentration	= 500 ppm

Which one of the following is the final RCS boron concentration required to support increasing plant power from 30% to 80% by boration/dilution with 10 inches of outward control rod (CEA) motion. (Assume no change in xenon reactivity.)

A. 390 ppm

B. 420 ppm

C. 450 ppm

D. 470 ppm

QUESTION: 82

The reactor is exactly critical below the point of adding heat (POAH) during a reactor startup at the end of core life. Control rods (CEAs) are withdrawn for 20 seconds to establish a 0.5 dpm startup rate.

Reactor power will increase:

A. continuously until control rods are reinserted.

B. and stabilize at a value slightly below the POAH.

C. temporarily, then stabilize at the original value.

D. and stabilize at a value slightly above the POAH.

QUESTION: 83

As moderator temperature decreases, the magnitude of differential rod worth will:

A. decrease due to shorter neutron migration length.

B. increase due to better moderation of neutrons.

C. decrease due to increased resonance absorption of neutrons.

D. increase due to increased neutron absorption in moderator.

QUESTION: 84

After a control rod (CEA) is fully inserted (from the fully withdrawn position), the effect on the axial flux shape is minimal. This is because:

A. the differential rod worth is constant along the length of the control rod.

B. the fully inserted control rod is an axially uniform poison.

C. a control rod only has reactivity worth if it is moving.

D. a variable poison distribution exists throughout the length of the control rod.

QUESTION: 85

The control rod (CEA) insertion limits are power dependent because the magnitude of:

A. power defect increases as power increases.

B. control rod worth decreases as power increases.

C. Doppler (fuel temperature) coefficient decreases as power increases.

D. moderator temperature coefficient increases as power increases.

QUESTION: 86

Immediately after a reactor trip from sustained high power operation, Xenon-135 concentration in the reactor will:

A. increase due to the decay of iodine already in the core.

B. decrease because xenon is produced directly from fission.

C. remain the same because the decay of iodine and xenon balance each other out.

D. decrease immediately, then slowly increase due to the differences in the half-lives of iodine and xenon.

QUESTION: 87

A reactor was operating for 42 weeks at a stable reduced power level when a reactor trip occured. The reactor was returned to critical after 12 hours and then ramped to 60% power in 6 hours.

How much time at steady state 60% power will be required to reach equilibrium xenon?

A. 20 to 30 hours

B. 40 to 50 hours

C. 70 to 80 hours

D. Unable to determine without knowledge of previous power history

QUESTION: 88

Two identical reactors have been operating at a constant power level for 1 week. Reactor A is at 50% power and Reactor B is at 100% power.

If both reactors trip/scram at the same time, Xe-135 will peak first in reactor _____ and the highest Xe-135 reactivity peak will occur in reactor _____.

A. A; B

B. A; A

C. B; B

D. B; A

QUESTION: 89

Which one of the following will cause reactor power to slowly fluctuate between the top and bottom of the core with steady state steam demand?

A. Feedwater variations

B. Dropped center control rod (CEA)

C. Xenon oscillation

D. Samarium oscillation

QUESTION: 90

A reactor startup is being performed 5 hours after a reactor scram from 100% equilibrium power. The plant is being returned to rated power at 2.0%/min instead of the normal rate of 0.5%/min.

At the faster rate of power increase, the minimum amount of core xenon will occur _____ and the amount of equilibrium core xenon will be _____.

A. sooner; the same

B. sooner; smaller

C. later; the same

D. later; smaller

QUESTION: 91

A reactor has been operating at full power for several days when it is shut down rapidly (within 2 hours) for maintenance. How will core xenon reactivity change?

A. Peak in 6 to 10 hours and then decay to near zero in 3 to 4 days.

B. Peak in 6 to 10 hours and then decay to near zero in about 1 day.

C. Peak in 2 to 4 hours and then decay to near zero in 3 to 4 days.

D. Peak in 2 to 4 hours and then decay to near zero in about 1 day.

QUESTION: 92

The reactor is near the end of its fuel cycle. Reactor power and coolant temperature are being allowed to "coastdown."

Why is boron dilution no longer used to compensate for fuel depletion?

A. Boron concentration has become so high that very large amounts of boron must be added to produce a small change in boron concentration.

B. The reactivity worth of the boron has decreased to such a low value that very large amounts of water must be added to produce a small change in reactivity.

C. Boron concentration has become so low that very large amounts of water must be added to produce a small change in boron concentration.

D. The reactivity worth of the boron has increased so much that reactivity changes via boron dilution cannot be safely controlled by the operator.

QUESTION: 93

Which one of the following will be controlled by an operator to add positive reactivity when taking the reactor critical during a reactor startup?

A. RCS boron and control rods only

B. Control rods and moderator temperature only

C. Moderator temperature, RCS boron, and control rods

D. RCS flow, control rods, and moderator temperature

QUESTION: 94

A reactor startup is in progress and the reactor is slightly subcritical. Assuming the reactor remains subcritical, a short control rod (CEA) withdrawal will cause the reactor startup rate indication to increase rapidly in the positive direction, and then:

A. rapidly decrease and stabilize at a negative 1/3 dpm.

B. gradually decrease and stabilize at zero.

C. stabilize until the point of adding heat is reached; then decrease to zero.

D. continue a rapid increase until the point of adding heat is reached; then decrease to zero.

QUESTION: 95

During a reactor startup, the operator adds 1.0% ΔK/K of positive reactivity by withdrawing control rods (CEAs), thereby increasing equilibrium source range neutron level from 220 cps to 440 cps.

To raise equilibrium source range neutron level to 880 cps, an additional _____ of positive reactivity must be added.

A. 4.0% ΔK/K

B. 2.0% ΔK/K

C. 1.0% ΔK/K

D. 0.5% ΔK/K

QUESTION: 96

Which one of the following statements describes count rate characteristics after a 5 second control rod (CEA) withdrawal with the reactor very close to criticality? (Assume the reactor remains subcritical).

A. There will be no change in count rate until criticality is achieved.

B. The count rate will rapidly increase (prompt jump) to a stable higher value.

C. The count rate will rapidly increase (prompt jump) then gradually increase and stabilize at a higher value.

D. The count rate will rapidly increase (prompt jump) then gradually decrease and stabilize at the previous value.

QUESTION: 97

The following data were obtained during a reactor startup:

Rod Position (units withdrawn)	Count Rate (CPS)
0	20
10	25
15	29
20	33
25	40
30	50

Assuming uniform differential rod worth, at what rod height will criticality occur?

A. 35 to 45 units withdrawn

B. 46 to 55 units withdrawn

C. 56 to 65 units withdrawn

D. 66 to 75 units withdrawn

QUESTION: 98

An estimated critical rod position (ECP) has been calculated for a reactor startup to be performed 15 hours after a trip from 100% power equilibrium conditions. Which one of the following conditions would cause the actual critical rod position to be <u>higher</u> than the predicted critical rod position?

A. A 90% value for reactor power was used in the ECP calculation.

B. Reactor criticality is achieved approximately 2 hours earlier than anticipated.

C. Steam generator pressures are decreased by 100 psi just prior to criticality.

D. Current boron concentration is 10 ppm lower than the value used in the ECP calculation.

QUESTION: 99

With K_{eff} = 0.985, how much reactivity must be added to make the reactor <u>exactly</u> critical?

A. 1.54% Δk/k

B. 1.52% Δk/k

C. 1.50% Δk/k

D. 1.48% Δk/k

QUESTION: 100

A reactor is critical several decades below the point of adding heat (POAH) when a small amount of <u>positive</u> reactivity is added to the core. If the exact same amount of <u>negative</u> reactivity is again added to the core prior to reaching the POAH, reactor power will stabilize:

A. higher than the initial power level but below the POAH.

B. lower than the initial power level.

C. at the initial power level.

D. at the POAH.