JUL 19 1990

Docket No. 50-498/499

Houston Lighting and Power
ATTN: Donald P. Hall
Group VP - Nuclear
P. O. Box 1700
Houston, TX 77251

Gentlemen:

On June 6, 1990, the NRC administered the Generic Fundamentals Examination Section (GFES) of the written operator licensing examination to an employee of your facility. Enclosed with this letter provided to your training department is a copy of the examination (including the answer key), the grading results for your facility, and a copy of the individual answer sheet for the examinee from your facility. Your training department is requested to forward the results and the answer sheet to the examinee.

In accordance with 10 CFR 2.790 of the Commission's Regulations, a copy of this letter and Enclosure 1 will be placed in the NRC's Public Document Room (PDR). The results for individual examinees are exempt from disclosure; therefore, Enclosures 2 and 3 will not be placed in the PDR.

Questions concerning this examination should be directed to Mr. Paul Boyle at (301) 492-1047.

Sincerely,

Onginal Signed By:
Samuel J. Collins

Samuel J. Collins, Director
Division of Reactor Projects

Enclosures: As stated

cc:
Houston Lighting & Power Company
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DRS:OLS:LA	DRS:OLS:SC	DRS:DivDir	DRP:DivDir
EMHimes	JLPellet	LJCallan	SJCollins
7/18/90	7/18/90	7/19/90	7/19/90

IE42
1/1

bcc w/Enclosure 1:
DMB (IE42)
PDR w/Encl 1

bcc distribution by RIV:
R. D. Martin
MIS System
J. L. Pellet
E. M. Himes
NRR Project Manager
DRP SC
RIV file
L. Miller, TTC
DRS (J. Pellet rdg file)

UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 1990 - 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) Three handouts are provided for your use during the examination, an Equations and Conversions sheet, instructions for filling out the answer sheet, and Steam Table booklets.

(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) Any questions about an item on the examination should be directed to the examiner only.

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

(10) 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.

(11) 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.

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

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

EQUATION SHEET

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

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

$Q = UA \Delta T$

$SUR = 26.06/\tau$

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

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

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

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

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

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

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

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

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

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

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

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

$Pwr = W_t \dot{m}$

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

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

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

$$\nu(P_o - P_1) + 1/2 (\vec{V}_o^2 - \vec{V}_1^2) + g(z_o - z_1) = 0$$

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1 Curie = 3.7×10^{10} dps

1 hp = 2.54×10^3 BTU/hr

1 BTU = 778 ft-lbf

°C = 5/9 (°F - 32)

1 kg = 2.21 lbm

1 Mw = 3.41×10^6 BTU/hr

°F = 9/5 °C + 32

QUESTION: 1

The difference between the setpoint pressure at which a safety/relief valve opens and the pressure at which it closes is called:

A. blowdown.

B. accumulation.

C. setpoint tolerance.

D. setpoint deviation.

QUESTION: 2

The function of a valve backseat is to:

A. isolate system pressure from the packing and stuffing box to minimize packing leakage.

B. isolate system pressure from the packing and stuffing box for the purpose of valve repacking during normal system operation.

C. provide a backup means of flow isolation in the event of primary seat leakage.

D. provide a backup means of flow isolation in the event of a pipe break.

QUESTION: 3

A stop check valve is a modified check valve that:

A. cannot be shut remotely.

B. can be used to prevent flow in both directions.

C. can be opened manually to allow flow in both directions.

D. contains both a gate valve disk and a check valve disk.

QUESTION: 4

Operators should use BOTH hands on valve handwheels when positioning manual valves to:

A. overcome the resistance of installed locking devices.

B. control the rate of valve motion to prevent water hammer.

C. ensure system pressure, temperature, and flow are controlled during valve motion.

D. control lateral force to prevent bending the valve stem.

QUESTION: 5

If the steam pressure input to a density-compensated steam flow instrument fails high, the INDICATED flow rate will:

A. increase, because the density input has increased.

B. increase, because the density input has decreased.

C. decrease, because the density input has increased.

D. decrease, because the density input has decreased.

QUESTION: 6

A differential pressure (D/P) cell is being used to measure flow rate in a cooling water system. Flow rate is indicating 75 percent of scale. If the D/P cell diaphragm ruptures, INDICATED flow rate will:

A. go to 0 percent because low D/P is sensed.

B. go to 0 percent because high D/P is sensed.

C. go to 100 percent (full-scale) because low D/P is sensed.

D. go to 100 percent (full-scale) because high D/P is sensed.

QUESTION: 7

Which of the following will cause indicated volumetric flow rate to be LOWER than actual volumetric flow rate using a differential pressure (D/P) cell flow detector and a calibrated orifice?

A. Debris becomes lodged in the orifice.

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

C. The orifice erodes over time.

D. System pressure decreases.

QUESTION: 8

A cooling water system is operating at steady-state conditions indicating 900 gpm with 60 psid across the flow transmitter venturi. If cooling water flow rate is increased to 1800 gpm, flow transmitter venturi delta-p will be approximately:

A. 85 psid

B. 120 psid

C. 175 psid

D. 240 psid

QUESTION: 9

Tank water level indication from a (wet) reference leg differential pressure level instrument will be LOWER than actual level when ambient temperature is _____ than calibration conditions or when there is a break in the _____ leg of the D/P cell.

A. less; reference

B. less; variable

C. greater; reference

D. greater; variable

QUESTION: 10

Semiconductor strain gages are routinely used in transmitters for:

A. RCS pressure instruments.

B. RCS temperature instruments.

C. Control rod (CEA) position instruments.

D. Steam generator level instruments.

QUESTION: 11

Which of the following is a disadvantage of a thermocouple when compared to a resistance temperature detector (RTD)?

A. Lower accuracy of measurement

B. Requires external power supply for measurement

C. Inability to withstand high temperatures

D. Slower response to temperature change

QUESTION: 12

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

A. to mid-scale.

B. as is.

C. high.

D. low.

QUESTION: 13

An automatic tank level controller uses a potentiometer for manual adjustment of the level setpoint which is currently 60 percent. An operator increases the potentiometer setting to lower the level setpoint signal to a value previously known to maintain tank level at 50 percent. However, actual tank level stabilizes at 40 percent. The MOST LIKELY cause is that:

A. the potentiometer slide bar has developed a thin film of corrosion, thereby increasing the resistance of the potentiometer.

B. the potentiometer wiper has lost contact with the slide bar, thereby allowing only fine setpoint adjustments.

C. the potentiometer wiper and slide bar have developed a short circuit, thereby decreasing the resistance of the potentiometer.

D. the potentiometer locking device has not been released, thereby allowing only coarse setpoint adjustments.

QUESTION: 14

An ion chamber radiation detector is exposed to a constant gamma radiation field. If the applied voltage is increased but maintained within the ion chamber region, the rate of ion collection will _____. If the applied voltage is constant and the gamma radiation field is increased, the rate of ion collection will _____ the gamma radiation field strength.

A. increase; stay approximately the same

B. stay approximately the same; stay approximately the same

C. increase; increase

D. stay approximately the same; increase

QUESTION: 15

Scintillation detectors operate on the principle of:

A. gas amplification.

B. space charge effect.

C. luminescence.

D. photoionization.

QUESTION: 16

Which of the following features is NORMALLY used for neutron detection with an ion chamber?

A. Line the inside of the detector with polyethylene.

B. Line the inside of the detector with Boron-10.

C. Encapsulate the detector with polyethylene.

D. Encapsulate the detector with Boron-10.

QUESTION: 17

The governor of an emergency diesel generator (D/G) DIRECTLY senses D/G _____ and adjusts D/G _____ flow to maintain a relatively constant D/G frequency.

A. load; air

B. speed; fuel

C. load; fuel

D. speed; air

QUESTION: 18

The purpose of a valve positioner in a typical pneumatic control system is to:

A. convert a small air pressure into a proportionally larger air pressure to adjust valve position.

B. convert a large air pressure into a proportionally smaller air pressure to adjust valve position.

C. convert pneumatic force into a mechanical force to adjust valve position.

D. convert mechanical force into pneumatic force to adjust valve position.

QUESTION: 19

What type of controller will return a process parameter to its setpoint value after a system transient?

A. Proportional

B. Proportional-Integral

C. Proportional-Functional

D. Proportional-Differential

QUESTION: 20

Why must an operator pay particular attention to auto/manual valve controllers left in the MANUAL mode?

A. Manual valve control is not as stable as automatic valve control.

B. Valve position will no longer change in response to changes in system parameters.

C. System parameters will no longer change in response to changes in valve position.

D. The valve can only be operated locally during manual valve control.

QUESTION: 21

A centrifugal pump with no recirculation flow path must be stopped when discharge pressure reaches pump shutoff head to prevent:

A. bursting of the pump casing by subjecting it to excessively high pressure.

B. water hammer in downstream lines when system pressure drops to a value where the pumps can inject water.

C. overheating of the motor.

D. overheating of the pump.

QUESTION: 22

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

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

B. discharge pressure minus suction pressure.

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

D. suction pressure plus discharge pressure.

QUESTION: 23

A closed system has one operating positive displacement pump in service. A second positive displacement pump is subsequently placed into service. If the pumps are in parallel, the system flow rate will _____ and the system discharge pressure will _____.

A. stay approximately the same; stay approximately the same

B. approximately double; stay approximately the same

C. stay approximately the same; approximately double

D. approximately double; approximately double

QUESTION: 24

Which of the following is an indication of pump runout?

A. High discharge pressure

B. Low pump motor current

C. High pump vibration

D. Low pump flow rate

QUESTION: 25

Increasing the flow rate from a centrifugal pump by throttling open the discharge valve will cause pump head to:

A. increase and stabilize at a higher value.

B. decrease and stabilize at a lower value.

C. remain constant because pump head is a design parameter.

D. increase, then decrease following the pump's efficiency curve.

QUESTION: 26

A positive displacement pump (PDP) is operating in an open system. PDP parameters are as follows:

PDP speed - 1000 rpm
PDP discharge pressure - 2000 psig
PDP suction pressure - 50 psig
PDP flow rate - 150 gpm

Which one of the following changes will cause PDP flow rate to exceed 200 gpm?

A. A second identical discharge path is opened.

B. Increase PDP speed to 1500 rpm.

C. Increase PDP suction pressure to 120 psig.

D. Decrease downstream system pressure to 1000 psig.

QUESTION: 27

Which one of the following indications can be used to determine whether a reactor coolant pump has experienced a locked rotor vice a sheared rotor?

A. Affected loop flow rate

B. Affected RCP breaker position

C. Unaffected loop flow rate

D. Reactor trip status

QUESTION: 28

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, 44 amps

B. 25 psi, 44 amps

C. 22 psi, 55 amps

D. 25 psi, 55 amps

QUESTION: 29

Which of the following best describes the motor current indications that would be observed during the start of a large AC motor at full load?

A. Amps slowly increase to the full-load value over a period of five time constants.

B. Amps immediately increase to the full-load value.

C. Amps immediately increase to many times the full-load value and then decrease to the full-load value.

D. Amps immediately increase to the full-scale value and then decrease rapidly to zero due to overload protection.

QUESTION: 30

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

A. torsional stresses on the motor shaft.

B. wear of internal pump components.

C. arcing and degradation of motor breaker contacts.

D. heat buildup within the motor.

QUESTION: 31

During normal steady-state plant operation with a constant generator load, plugging of one percent of the tubes in the main condenser will cause absolute pressure in the condenser to _____ and hotwell temperature to _____.

A. increase; increase

B. decrease; increase

C. increase; decrease

D. decrease; decrease

QUESTION: 32

During normal steady-state plant operation at 50 percent load, which one of the terms in the formula, $\dot{Q} = UA(T1-T2)$, is (affected the most, and therefore) most responsible for the initial increase in heat transfer rate from the reactor coolant during a minor (3 percent) steamline break?

A. U

B. A

C. T1

D. T2

QUESTION: 33

With the plant operating at full power, increased condensate conductivity will result from:

1. Condenser shell crack
2. Cooling water tube failure

A. 1. only

B. 2. only

C. Both 1. and 2.

D. Neither 1. or 2.

QUESTION: 34

A crack in the shell of the main condenser will cause cooling water outlet temperature to _____ and hotwell temperature to _____.

A. increase; decrease

B. decrease; decrease

C. increase; increase

D. decrease; increase

QUESTION: 35

The temperature of the water passing through a demineralizer must be controlled because EXCESSIVELY HOT water will:

A. accelerate the ion exchange process and possibly change pH.

B. degrade the corrosion inhibitor applied to the inner wall of the demineralizer.

C. result in demineralizer retention element thermal expansion, thereby releasing resin.

D. reduce the affinity of the demineralizer resin for ion exchange.

QUESTION: 36

Prior to a scheduled plant shutdown, the reactor (primary) coolant system was chemically shocked to induce a crud burst. What effect will this have on the letdown purification demineralizers?

A. Increased flow rate through the demineralizers

B. Demineralizers will become boron saturated

C. Decreased demineralizer outlet conductivity

D. Increased pressure drop across demineralizer

QUESTION: 37

The plant is operating at 70 percent equilibrium power level when the temperature of reactor coolant letdown passing through a saturated mixed bed ion exchanger is decreased by 20 degrees 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. decrease; decreased

B. decrease; increased

C. increase; decreased

D. increase; increased

QUESTION: 38

Loss of breaker control power will:

A. prevent local closing of the breaker.

B. prevent local tripping of the breaker.

C. prevent the breaker from tripping on interlock.

D. prevent the breaker from tripping on overcurrent.

QUESTION: 39

The PRIMARY reason for isolating emergency electrical loads from their power supply bus prior to energizing the bus via the emergency diesel generator is to prevent:

A. an overcurrent condition on the generator.

B. an overcurrent condition on the loads.

C. an underfrequency condition on the generator.

D. an underfrequency condition on the loads.

QUESTION: 40

During paralleling operations of the main generator to the grid, closing the generator output breaker with the generator voltage slightly lower than grid voltage and with generator frequency slightly higher than grid frequency will result in:

A. the generator picking up a reactive load from the grid.

B. the generator immediately attaining a leading power factor.

C. the generator shedding real load to the grid.

D. motoring of the generator.

QUESTION: 41

While paralleling the main generator to the grid, the generator breaker must be closed as the synchroscope pointer approaches the 12 o'clock position to prevent:

A. motoring of the generator due to unequal frequencies.

B. excessive arcing within the generator output breaker due to unequal voltages.

C. excessive MWe load transfer to the generator due to unequal frequencies.

D. excessive heating of the generator windings due to excessive surge currents.

QUESTION: 42

High voltage electrical disconnects are PRIMARILY used to:

A. isolate electrical equipment for personnel safety.

B. tie electrical buses together for increased capacity.

C. provide electrical equipment protection against a faulted electrical bus.

D. isolate electrical buses to ensure separation of power supplies.

QUESTION: 43

The following indications are observed for a breaker.

Red indicating light is on
Green indicating light is off
Load voltage indicates 0 volts
Line voltage indicates 480 volts

What is the condition of the breaker?

A. Open and racked in

B. Shut and racked in

C. Open and racked to "test" position

D. Shut and racked to "test" position

QUESTION: 44

A thermal overload device for a large motor protects the motor from:

A. sustained overcurrent by opening motor line contacts at the motor.

B. instantaneous overcurrent by opening motor line contacts at the motor.

C. sustained overcurrent by opening the motor breaker.

D. instantaneous overcurrent by opening the motor breaker.

QUESTION: 45

With the plant operating at 85 percent power and rod (CEA) control in Manual, the operator borates 10 ppm. Shutdown margin will:

A. increase and stabilize at a higher value.

B. increase, then decrease to the original value as temperature changes.

C. decrease and stabilize at a lower value.

D. decrease, then increase to the original value as temperature changes.

QUESTION: 46

A reactor is operating at steady-state 100 percent power with all control rods (CEAs) fully withdrawn. Tave is 588 degrees F and boron concentration is 1000 ppm. A reactor trip occurs, after which Tave stabilizes at 557 degrees F and all control rods are verified to be fully inserted.

Given the following information, calculate the value of shutdown margin. Assume no operator actions and disregard any reactivity effects of xenon.

Power Coefficient = -0.015% delta-K/K/% power
Control/Regulating Rod Worth = -2.788% delta-K/K
Shutdown/Safety Rod Worth = -4.130% delta-K/K
MTC = -0.0012% delta-K/K per degree F

A. -5.381% delta-K/K

B. -5.418% delta-K/K

C. -8.383% delta-K/K

D. -8.418% delta-K/K

QUESTION: 47

Which one of the following statements is a characteristic of subcritical multiplication?

A. The subcritical neutron level is directly proportional to the neutron source strength.

B. Doubling the indicated count rate by reactivity additions will reduce the margin to criticality by approximately one quarter.

C. For equal reactivity additions, it takes less time for the new equilibrium source range count rate to be reached as Keff approaches unity.

D. An incremental withdrawal of any given control rod (CEA) will produce an equivalent equilibrium count rate increase, whether Keff is 0.88 or 0.92.

QUESTION: 48

Which of the following statements describes the EFFECT of changes in the delayed neutron fraction over core life?

A. A higher critical boron concentration is required at end of life.

B. A lower critical boron concentration is required at end of life.

C. A given reactivity addition at end of life results in a higher startup rate than it would at beginning of life.

D. A given reactivity addition at end of life results in a lower startup rate than it would at beginning of life.

QUESTION: 49

Neutron sources are installed in the reactor core for which of the following reasons?

A. Subcritical multiplication cannot occur without neutron sources.

B. They compensate for those neutrons absorbed in burnable poisons.

C. They increase neutron population sufficiently to allow detection on nuclear instrumentation.

D. They provide enough neutrons to start a chain reaction for startup.

QUESTION: 50

The fuel temperature coefficient of reactivity will become LESS NEGATIVE following a/an:

A. increase in core age from BOC to EOC.

B. fuel temperature decrease.

C. boron dilution.

D. moderator temperature increase.

QUESTION: 51

The amount of boric acid required to increase the coolant boron concentration by 10 ppm at beginning of cycle (BOC) conditions (1200 ppm) is approximately _____ as the amount of boric acid required to increase boron concentration by 10 ppm at end of cycle (EOC) conditions (100 ppm).

A. twelve times as large

B. eight times as large

C. four times as large

D. the same

QUESTION: 52

Given the following initial parameters, select the final coolant boron concentration needed to DECREASE average coolant temperature by 4 degrees F by chemical shim only (no change in rod position or plant/turbine power).

Initial RCS boron concentration = 600 ppm
Moderator temperature coefficient = -.015% delta-k/k per degree F
Differential boron worth = -.010% delta-k/k per ppm
Inverse boron worth = -100 ppm per % delta-k/k

A. 606 ppm

B. 603 ppm

C. 597 ppm

D. 594 ppm

QUESTION: 53

The plant is being returned to operation following a refueling outage. Most of the positive reactivity added by the operator during the reactor power increase from 10 percent power to full power is required to overcome the negative reactivity from:

A. fuel burnup.

B. xenon buildup.

C. fuel temperature increase.

D. moderator temperature increase.

QUESTION: 54

The reactor is exactly critical below the point of adding heat. Control rods (CEAs) are manually inserted for 5 seconds. Reactor power will:

A. decrease to a shutdown power level low in the source (startup) range.

B. decrease temporarily, then return to the original value due to the resulting decrease in moderator temperature.

C. decrease until inherent positive reactivity feedback causes the reactor to become critical at a lower neutron level.

D. decrease temporarily, then return to the original value due to subcritical multiplication.

QUESTION: 55

By maintaining the radial and axial core thermal limits within prescribed tolerances, the operator is assured that _____ will remain within acceptable limits.

A. power density (kw/ft) and departure from nucleate boiling ratio (DNBR)

B. departure from nucleate boiling ratio (DNBR) and hot channel heat flux

C. core delta-T and power density (kw/ft)

D. hot channel heat flux and core delta-T

QUESTION: 56

If a control rod (CEA) is fully inserted (from the fully withdrawn position), the axial flux shape will undergo a:

A. minor distortion, because the fully inserted control rod appears to be invisible.

B. minor distortion, because the fully inserted control rod is an axially uniform poison.

C. major distortion, because the upper and lower core halves are loosely coupled.

D. major distortion, because power production along the length of the control rod drastically decreases.

QUESTION: 57

Which of the following is considered when establishing control rod (CEA) insertion limits?

1. Ensuring sufficient control rod movement is available for reactivity control
2. Ensuring minimum shutdown margin is available after a trip with one rod fully withdrawn
3. Minimizing the worth of an ejected control rod
4. Maintaining allowable power distribution

A. 1, 2, 3

B. 1, 2, 4

C. 1, 3, 4

D. 2, 3, 4

QUESTION: 58

Xenon-135 is produced in the reactor by two methods. One is directly from fission, the other is indirectly from the decay of:

A. Xenon-136.

B. Iodine-135.

C. Cesium-135.

D. Barium-135.

QUESTION: 59

A reactor has been operating at 50 percent power for one week when power is ramped in four hours to 100 percent power. Which statement best describes the new equilibrium xenon concentration?

A. The new xenon equilibrium value will be twice the 50 percent value.

B. The new xenon equilibrium value will be less than twice the 50 percent value.

C. The new xenon equilibrium value will be more than twice the 50 percent value.

D. The new xenon equilibrium value will remain the same since it is independent of power.

QUESTION: 60

A reactor has been operating at full power for several days when a reactor trip occurs. If the reactor had been operating at 50 percent power, xenon would peak _____ and the peak xenon reactivity would be _____.

A. earlier; the same

B. at the same time; the same

C. earlier; less negative

D. at the same time; less negative

QUESTION: 61

The plant has been operating at 100 percent power for two months when a reactor trip occurs. Six hours after the trip, the reactor is taken critical and power is raised to 2 percent. In order to maintain power stable at 2 percent, the operator must:

A. add positive reactivity because xenon is building in.

B. add negative reactivity because xenon is building in.

C. add positive reactivity because xenon is decaying away.

D. add negative reactivity because xenon is decaying away.

QUESTION: 62

Which of the following lists the reasons for using burnable poisons in an operating reactor.

1. Provide more uniform power density.
2. Counteract the effects of control rod (CEA) burnout.
3. Allow higher fuel enrichment of initial core load.
4. Provide neutron flux shaping.

A. 1, 2, 3

B. 1, 2, 4

C. 1, 3, 4

D. 2, 3, 4

QUESTION: 63

The reactor is near the end of its operating cycle. In order to stay critical, power and temperature have been allowed to "coastdown." Why is boron no longer used to compensate for fuel depletion?

A. Boron concentration approaches zero and requires very large amounts of water to dilute.

B. The reactivity worth of the boron has decreased to an unacceptably low value.

C. The boron in the coolant has been depleted due to neutron absorption.

D. "Coastdown" is preferred due to fuel conditioning limitations.

QUESTION: 64

Which of the following combinations of parameters should be closely monitored and controlled during the approach to criticality?

1. Axial flux difference (axial shape index)
2. Reactor startup rate
3. Source range (neutron) count rate
4. Rod (CEA) position

A. 1, 2, 3

B. 1, 2, 4

C. 1, 3, 4

D. 2, 3, 4

QUESTION: 65

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. The count rate will rapidly increase (prompt jump) then gradually increase to a stable value.

B. The count rate will rapidly increase (prompt jump) then gradually decrease to the previous value.

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

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

QUESTION: 66

During fuel loading, which of the following will effect the shape of a 1/M plot?

1. Location of the neutron source(s) in the core
2. Location of the neutron detectors around the core
3. Strength of the neutron sources in the core
4. Order of placement of the fuel assemblies during loading

A. 1, 2, 3

B. 1, 2, 4

C. 1, 3, 4

D. 2, 3, 4

QUESTION: 67

Which of the following is needed to determine the estimated critical boron concentration for a reactor startup following an inadvertent reactor trip?

1. Power level one week prior to the trip
2. Power level at the time of the trip
3. Current reactor coolant boron concentration
4. Reactor coolant temperature at the time of the trip

A. 1, 2, 3

B. 1, 2, 4

C. 1, 3, 4

D. 2, 3, 4

QUESTION: 68

The reactor is critical at a stable power level below the point of adding heat. An unisolable steam line break occurs and 3 percent total steam flow is escaping. Assuming no reactor trip, which statement below describes the response of the reactor? (Assume a negative moderator temperature coefficient.)

A. The reactor will go subcritical. Tave will decrease.

B. The reactor will go to 3 percent power. Tave will increase.

C. The reactor will go to 3 percent power. Tave will decrease.

D. Power will not change because the reactor was below the point of adding heat. Tave will increase.

QUESTION: 69

The PRIMARY source of heat production with the reactor plant in Hot Standby one week after a reactor trip from 100 percent equilibrium power is:

A. reactor coolant pumps.

B. fission of activated U-235 and Pu-239.

C. spontaneous fission.

D. fission product decay.

QUESTION: 70

After one month of operation at 100 percent reactor power, _____ of the thermal power produced by the reactor comes from the decay of fission products.

A. greater than 10 percent

B. greater than 5 percent but less than 10 percent

C. greater than 1 percent but less than 5 percent

D. less than 1 percent

QUESTION: 71

Shortly after a reactor trip, reactor power indicates 0.5 percent where a stable negative SUR is attained. Reactor power will be reduced to 0.05 percent in approximately _____ seconds.

A. 90

B. 180

C. 270

D. 360

QUESTION: 72

Which of the following occurrences can cause reactor power to fluctuate between the top and bottom of the core when steam demand is constant?

A. Steam generator level oscillations

B. Iodine spiking

C. Xenon oscillations

D. Control valve cycling

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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. 1.0 psia

B. 1.5 psia

C. 3.0 psia

D. 15.0 psia

QUESTION: 74

An enclosed water storage tank has its upper volume pressurized with nitrogen to prevent oxygen absorption. A differential pressure detector with a dry reference leg is used to measure the tank level. For this type of level detector, the greatest accuracy will be achieved if the low pressure side of the detector is connected to:

A. the nitrogen volume at the top of the tank.

B. a dry reference leg open to atmosphere.

C. a sealed dry reference leg external to the tank.

D. the bottom of the tank.

QUESTION: 75

What is the reactor coolant system subcooling when Tave equals 400 degrees F and pressurizer pressure = 1,000 psig?

A. 45 degrees F

B. 75 degrees F

C. 100 degrees F

D. 146 degrees F

QUESTION: 76

If a wet vapor is at 130 degrees F and has a quality of 90 percent, its specific enthalpy is:

A. 1,015.7 BTU/lbm

B. 1,019.8 BTU/lbm

C. 1,117.8 BTU/lbm

D. 1,215.8 BTU/lbm

QUESTION: 77

What is the temperature and phase of the fluid downstream of the pressurizer relief valve if it were to stick open at 2,200 psia in the pressurizer with a 50 psia backpressure?

A. 281 degrees F, saturated

B. 281 degrees F, superheated

C. 332 degrees F, saturated

D. 332 degrees F, superheated

QUESTION: 78

Turbine "X" has 250 psia saturated steam at its entrance. Turbine "Y" has 250 psia, 500 degree F superheated steam at its entrance. Both turbines are 80 percent efficient and exhaust to a 1 psia condenser. Calculate the percentage of moisture at the exhaust of turbines X and Y.

A. Turbine X = 17.7 percent; turbine Y = 13.6 percent

B. Turbine X = 17.7 percent; turbine Y = 20.8 percent

C. Turbine X = 24.5 percent; turbine Y = 13.6 percent

D. Turbine X = 24.5 percent; turbine Y = 20.8 percent

QUESTION: 79

Which of the following actions will DECREASE plant efficiency?

A. Reducing steam moisture content.

B. Reducing condensate depression.

C. Increasing turbine exhaust pressure.

D. Increasing temperature of feedwater entering the steam generators.

QUESTION: 80

The reactor coolant system (RCS) is at 2000 psig when a leak of 85 gpm occurs. Which one of the following will be the approximate leak rate when RCS pressure reaches 1000 psig?

A. 38 gpm

B. 42 gpm

C. 56 gpm

D. 60 gpm

QUESTION: 81

The most serious concern with starting a feedwater pump with downstream fluid in a saturated condition is:

A. cavitation.

B. water hammer.

C. thermal shock.

D. positive reactivity addition.

QUESTION: 82

The condition that would MOST LIKELY cause cavitation of an operating centrifugal pump is:

A. lowering the suction temperature.

B. throttling the pump suction valve.

C. throttling the pump discharge valve.

D. decreasing the pump speed.

QUESTION: 83

Given the following initial core parameters:

$T_{\text{cladding-coolant interface}}$ = 500 degrees F
$T_{\text{fuel-cladding interface}}$ = 800 degrees F
$T_{\text{fuel centerline}}$ = 1400 degrees F

What would the fuel centerline temperature be if the FUEL thermal conductivity were doubled? (Assume reactor power is constant.)

A. 700 degrees

B. 950 degrees

C. 1100 degrees

D. 1250 degrees

QUESTION: 84

The power range nuclear instruments have been adjusted to 100 percent based on a calculated calorimetric. Which one of the following will result in actual reactor power being LESS than indicated reactor power?

A. The feedwater temperature used in the calorimetric calculation was higher than actual feedwater temperature.

B. The reactor coolant pump heat input term was omitted from the calorimetric calculation.

C. The feed flow used in the calorimetric calculation was lower than actual feed flow.

D. The steam pressure used in the calorimetric calculation is lower than actual steam pressure.

QUESTION: 85

Given the following plant conditions:

Power = 100 percent
Tave = 573.5 degrees F
Tstm = 513.5 degrees F

Calculate the new steam pressure if 5 percent of the total steam generator tubes are plugged and the plant is returned to 100 percent power. Assume RCS mass flow rate and reactor coolant temperature are unchanged.

A. 710.6 psia

B. 733.8 psia

C. 748.5 psia

D. 763.2 psia

QUESTION: 86

As heat is transferred to water adjacent to a heating surface, many factors influence steam bubble formation. Select the characteristic below that will ENHANCE steam bubble formation.

A. Chemicals dissolved in the water.

B. The absence of ionizing radiation exposure to the water.

C. A highly polished heat transfer surface with minimal scratches or cavities.

D. The presence of gases dissolved in the water.

QUESTION: 87

What type of boiling is described as follows: The bulk temperature of the liquid is below saturation, but the temperature of the heat transfer surface is above saturation. Vapor bubbles form at the heat transfer surface, but condense in the cold liquid so that no net generation of vapor is obtained.

A. Bulk boiling

B. Subcooled nucleate boiling

C. Total film boiling

D. Partial film boiling

QUESTION: 88

How does critical heat flux (CHF) vary with core height?

A. CHF increases from bottom to top of the core.

B. CHF decreases from bottom to core midplane, then increase from midplane to the top of the core.

C. CHF decreases from bottom to the top of the core.

D. CHF increases from bottom to core midplane, then decreases from midplane to the top of the core.

QUESTION: 89

Core heat transfer is MAXIMIZED by the presence of:

A. laminar flow with no nucleate boiling.

B. turbulent flow with no nucleate boiling.

C. laminar flow with nucleate boiling.

D. turbulent flow with nucleate boiling.

QUESTION: 90

The reactor coolant subcooling margin will be DIRECTLY REDUCED by: (Evaluate each change separately.)

A. increased pressurizer pressure.

B. increased pressurizer level.

C. increased reactor coolant flow.

D. increased reactor coolant temperature.

QUESTION: 91

Consider the temperature profile from the centerline of a fuel pellet to the centerline of the flow channel under 100 percent power conditions and single-phase cooling. Which of the following portions of the temperature profile will have the GREATEST temperature difference across it at the beginning of a fuel cycle?

A. Pellet-to-clad

B. Zircalloy cladding

C. Cladding corrosion film

D. Flow channel boundary layer

QUESTION: 92

Natural circulation flow can be ENHANCED by:

A. increasing the elevation of the heat source to equal that of the heat sink.

B. increasing the temperature difference between the heat sink and the heat source.

C. decreasing the temperature difference between the heat sink and the heat source.

D. decreasing the elevation difference between the heat source and the heat sink.

QUESTION: 93

Which of the following parameters provides the best indication of adequate core cooling following a small loss-of-coolant accident?

A. ECCS injection flow rate

B. Pressurizer level

C. Subcooling margin

D. Pressurizer pressure

QUESTION: 94

The pellet-to-clad gap in fuel rod construction is designed to:

A. decrease fuel pellet slump.

B. attenuate fission gammas.

C. increase heat transfer.

D. reduce internal clad strain.

QUESTION: 95

During full power operation, critical heat flux (CHF) is MOST LIKELY to occur in a:

A. centrally located fuel assembly with flow restrictions.

B. centrally located fuel assembly without flow restrictions.

C. peripherally located fuel assembly with flow restrictions.

D. peripherally located fuel assembly without flow restrictions.

QUESTION: 96

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

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

B. any clad temperature higher than this correlates to a fuel centerline temperature at the fuel melting point.

C. the corrosion rate of the zircalloy cladding increases sharply above 2200 degrees F.

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

QUESTION: 97

Brittle fracture of the RCS pressure boundary is MOST LIKELY to occur at:

A. 120 degrees F, 2200 psig.

B. 120 degrees F, 400 psig.

C. 400 degrees F, 2200 psig.

D. 400 degrees F, 400 psig.

QUESTION: 98

The probability of reactor vessel brittle fracture is DECREASED by minimizing:

A. oxygen content in the reactor vessel coolant.

B. the time taken to cool down the reactor coolant system.

C. operation at high temperatures.

D. the amount of copper in the reactor vessel.

QUESTION: 99

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

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

B. heatup stresses totally offset pressure stress at the inner wall.

C. cooldown stresses and heatup stresses are both tensile at the inner wall, but cooldown stresses are 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: 100

Prolonged exposure of the reactor vessel to a fast neutron flux will cause the nil ductility transition reference temperature (RT_{NDT}) to:

A. increase due to the propagation of existing flaws.

B. decrease due to the propagation of existing flaws.

C. increase due to changes in the material properties of the vessel wall.

D. decrease due to changes in the material properties of the vessel wall.