JUN 26 1991

Docket: 50-382
License: NPF-38

Entergy Operations, Inc.
ATTN: R. P. Barkhurst, VP -
Operations, Waterford
P.O. Box B
Killona, LA 70066

Gentlemen:

This letter forwards the results of the Generic Fundamentals Examination Section (GFES) of the written operator licensing examination that was administered on June 5, 1991, to nominated employees of your facility. We are forwarding the following items:

- the examination, including answer key,
- 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 Part 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 Mr. Paul Doyle at (301) 492-1058.

Sincerely,

Original Signed By:
Thomas P. Gwynn

for Samuel J. Collins, Director
Division of Reactor Projects

Enclosures: As stated

cc: next page

IE42
1/1

bcc to DMB (IE42)

bcc distribution by RIV:
R. D. Martin
MIS System
J. L. Pellet
E. M. Himes
NRR Project Manager (MS: 13-D-18)
DRP SC
RIV file
L. Miller, TTC
DRS (J. Pellet rdg file)

cc:
Entergy Operations, Inc.
ATTN: Charles Toth, Training
Manager, Waterford
P.O. Box B
Killona, LA 70066

DRS:OLS:LA
EMHimes
6/24/91

DRS:CLS:SC
JLPellet
6/24/91

DRS:DivDir
LJCallan
6/25/91

DRP:DivDir
SJCollins
6/26/91

ANSWER KEY FOR JUNE 1991 PWR GFE (Rev. 5/24)

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

UNITED STATES NUCLEAR REGULATORY COMMISSION
PRESSURIZED WATER REACTOR GENERIC FUNDAMENTALS EXAMINATION
JUNE 1991 - 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.

GENERIC FUNDAMETALS EXAMINATION SECTION
EQUATIONS AND CONVERSIONS HANDOUT SHEET

EQUATIONS

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

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

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

$SUR = 26.06/\tau$

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

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

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

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

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

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

$v(P_e - P_1) + \frac{1}{2} (\vec{v}_e^{\,2} - \vec{v}_1^{\,2}) + g(z_e - z_1) = 0$

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}

CONVERSIONS

1 Curie $= 3.7 \times 10^{10}$ dps

1 hp $= 2.54 \times 10^{3}$ BTU/hr

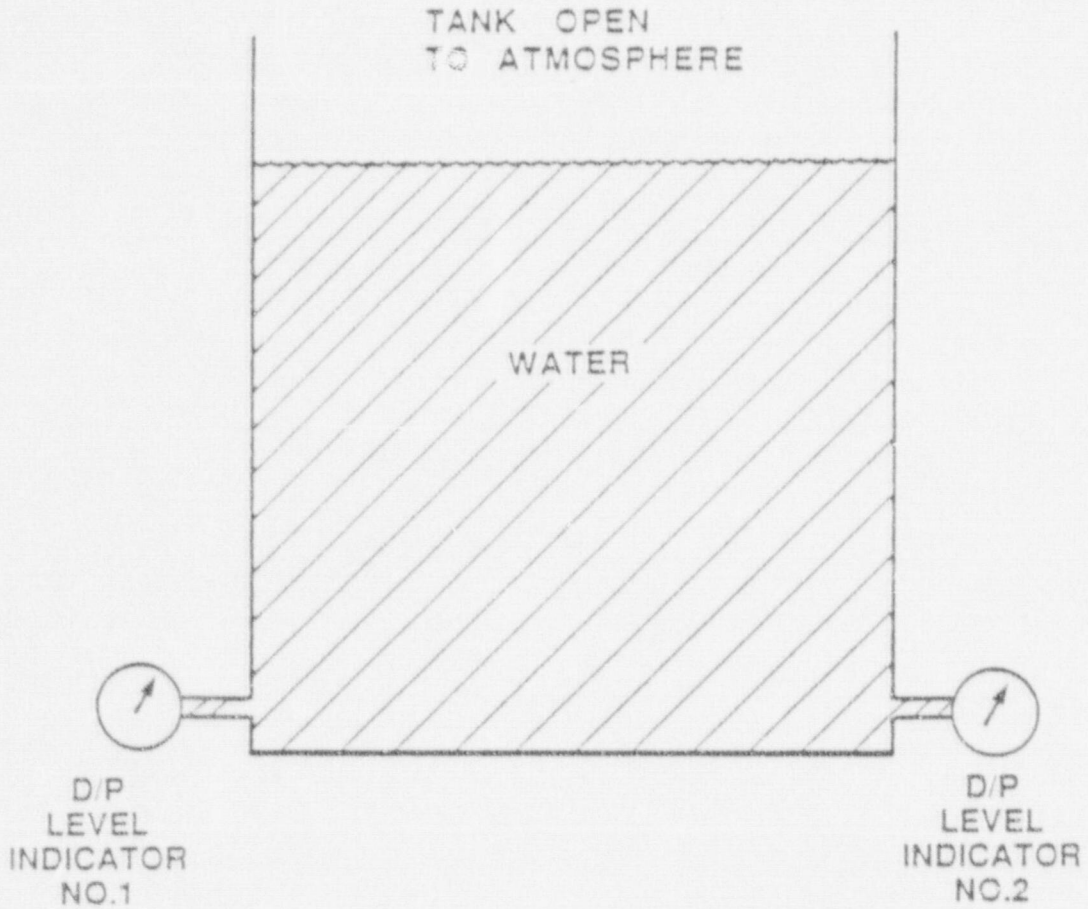
1 BTU $= 778$ ft-lbf

°C $= 5/9$ (°F - 32)

1 kg $= 2.21$ lbm

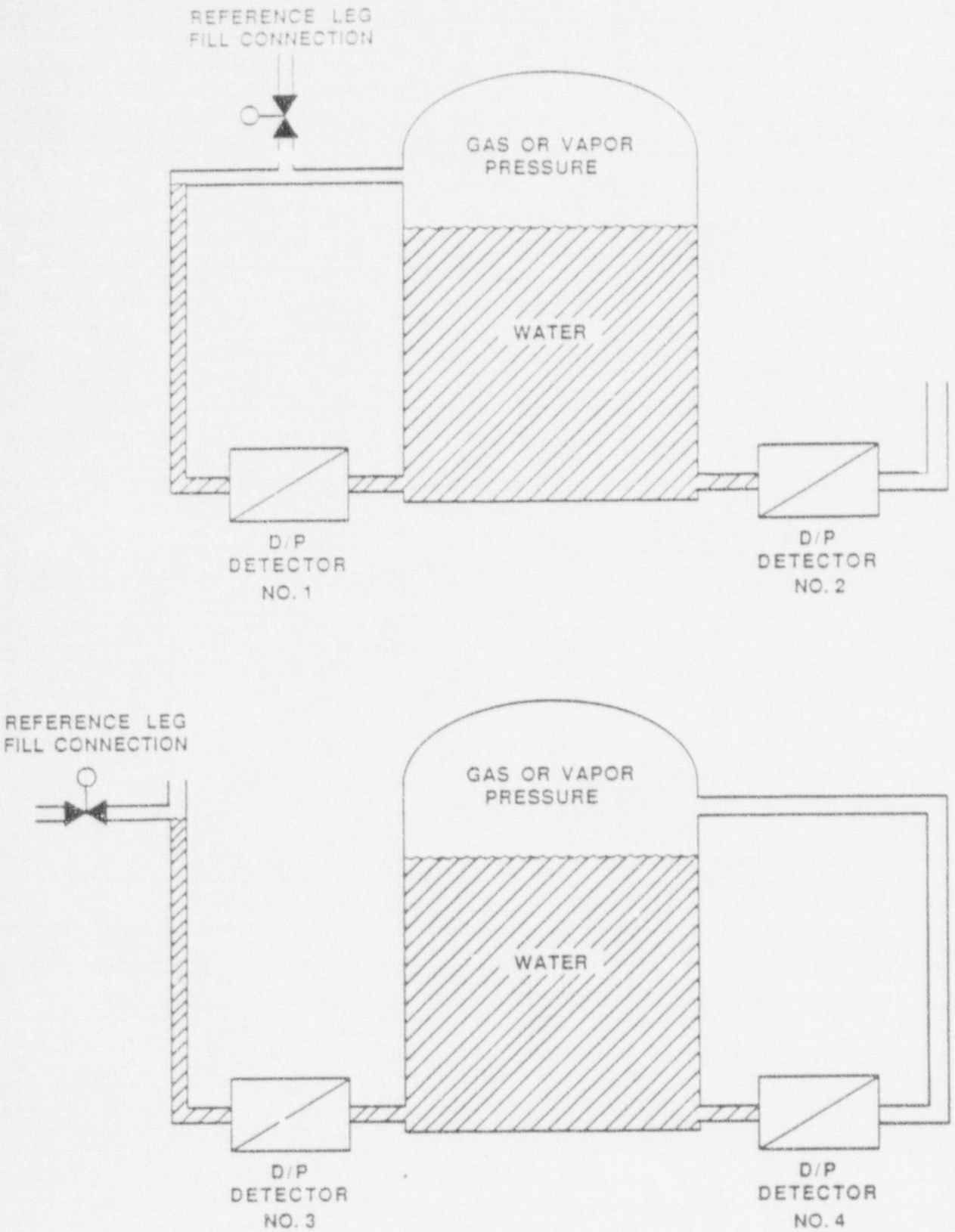
1 Mw $= 3.41 \times 10^{6}$ BTU/hr

°F $= 9/5$ °C + 32



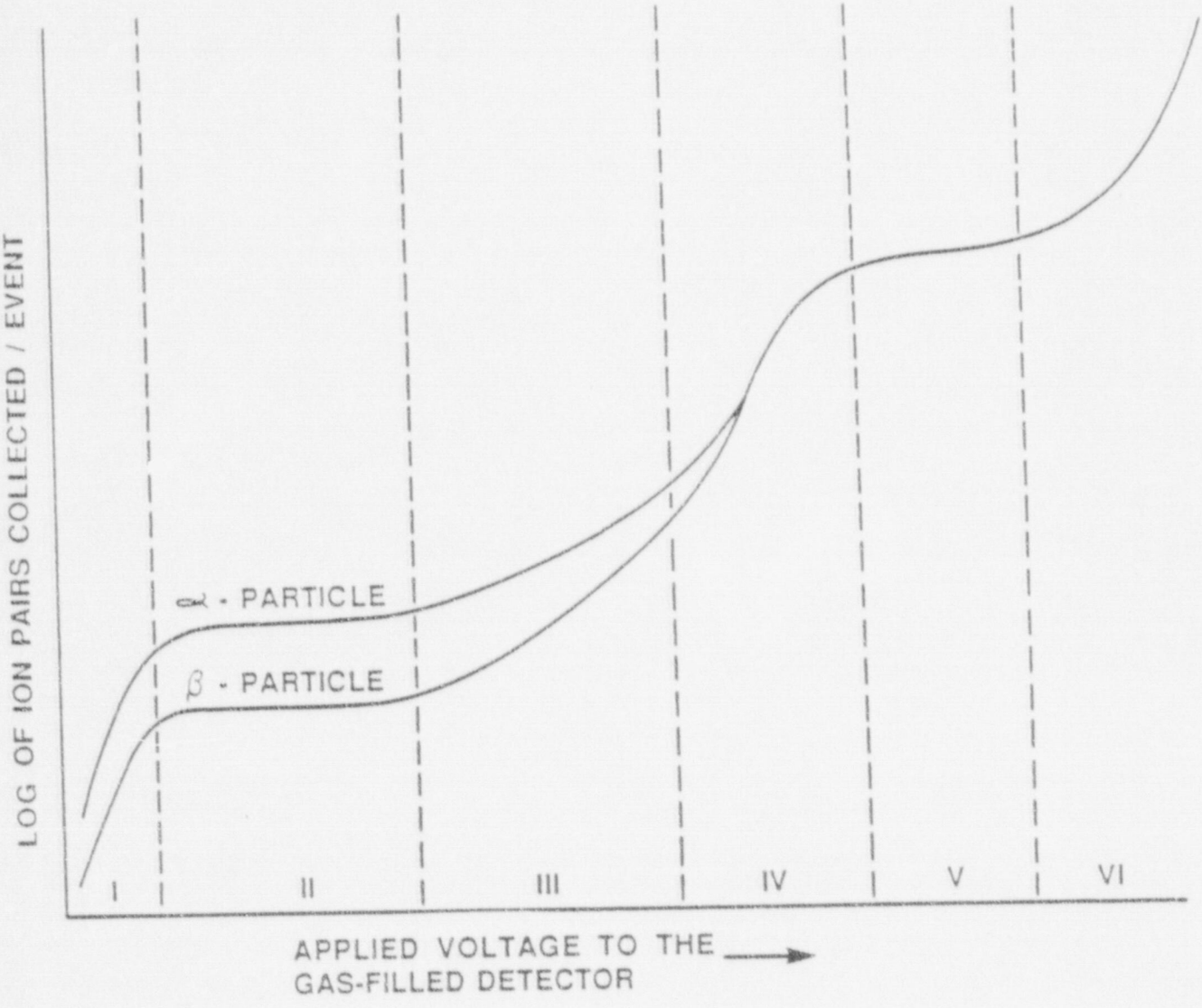
TANK DIFFERENTIAL PRESSURE LEVEL INDICATORS

FIGURE 1



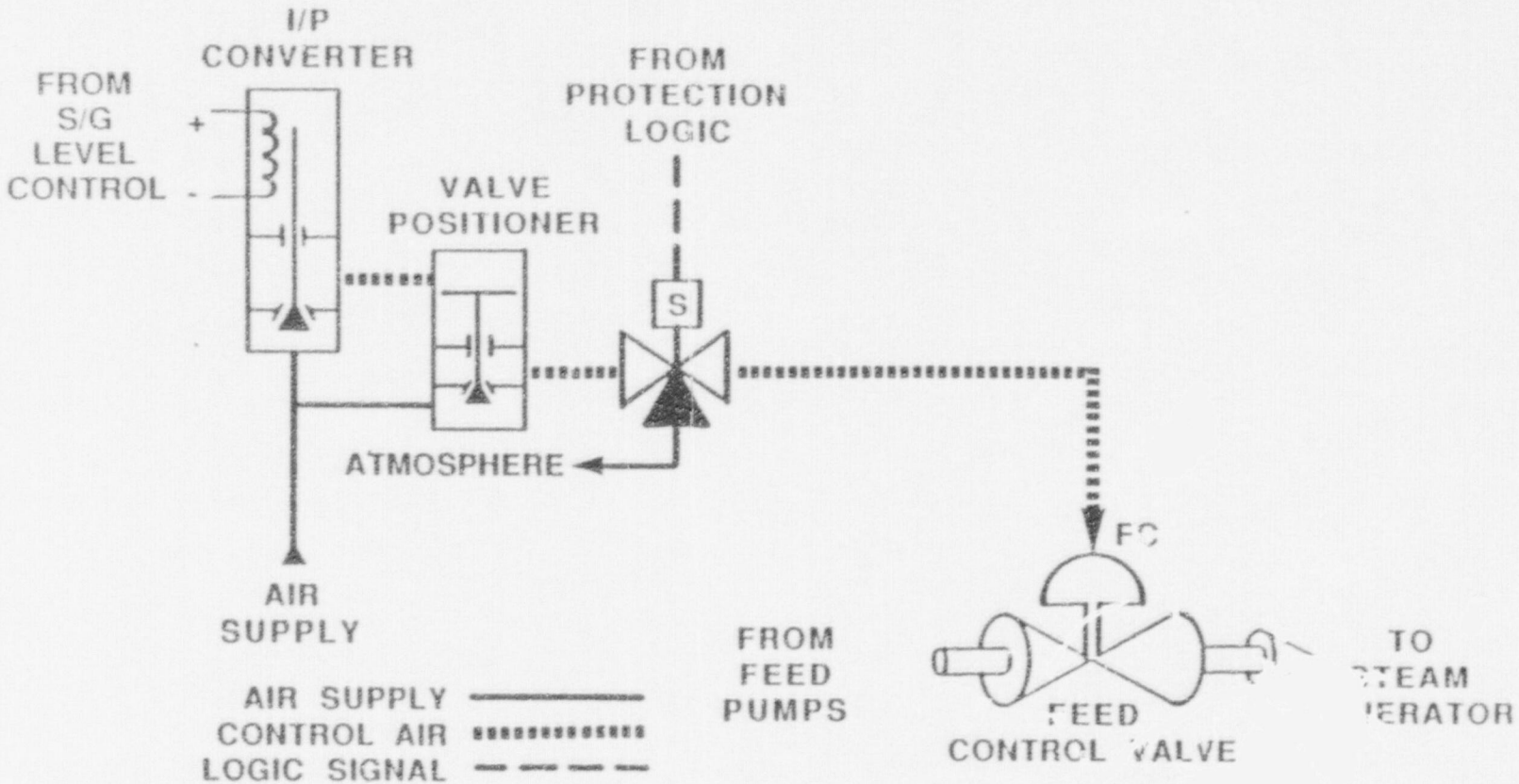
TANK DIFFERENTIAL PRESSURE LEVEL DETECTORS

FIGURE 2



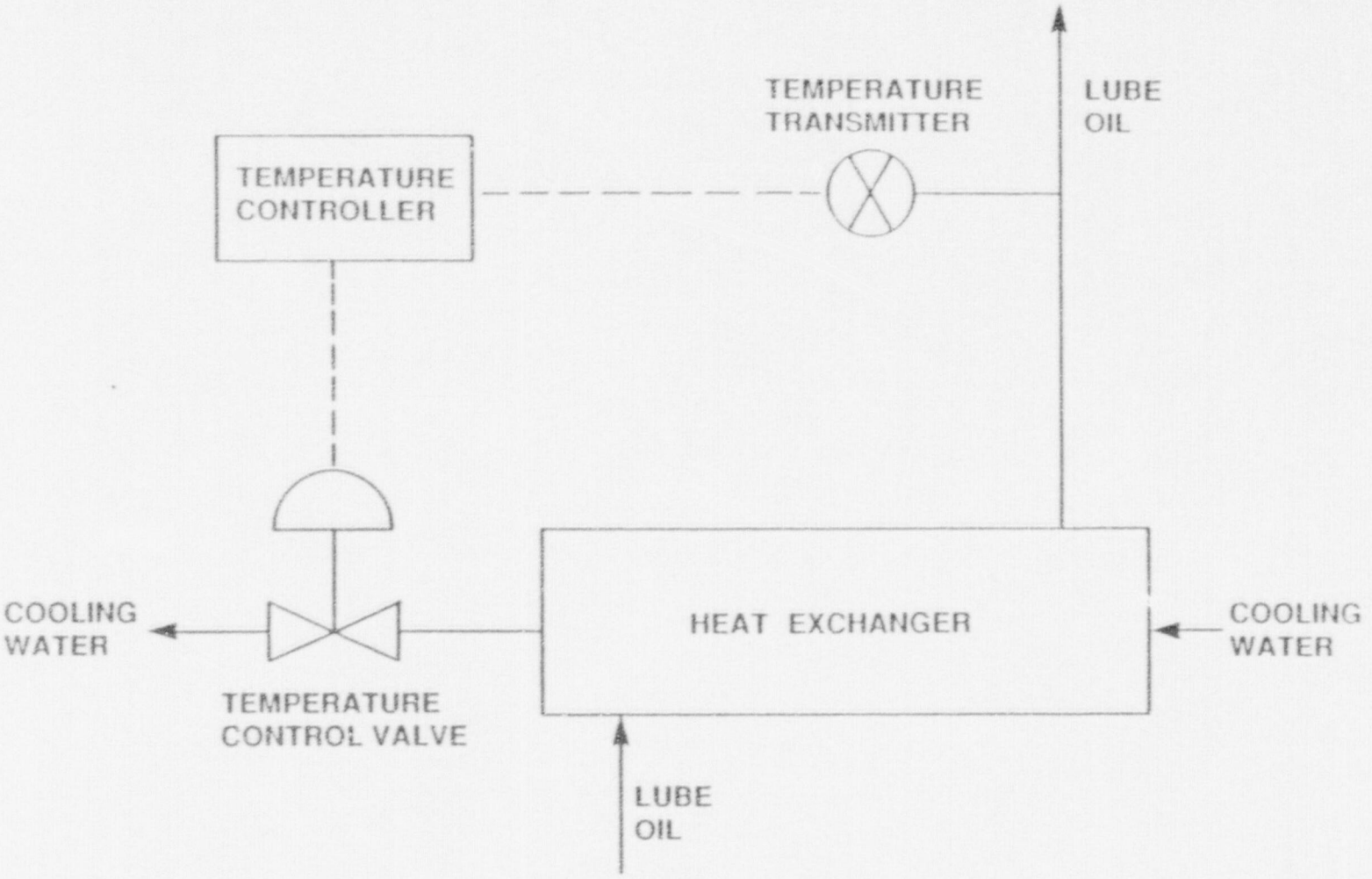
GAS-FILLED DETECTOR CHARACTERISTIC CURVE

FIGURE 3



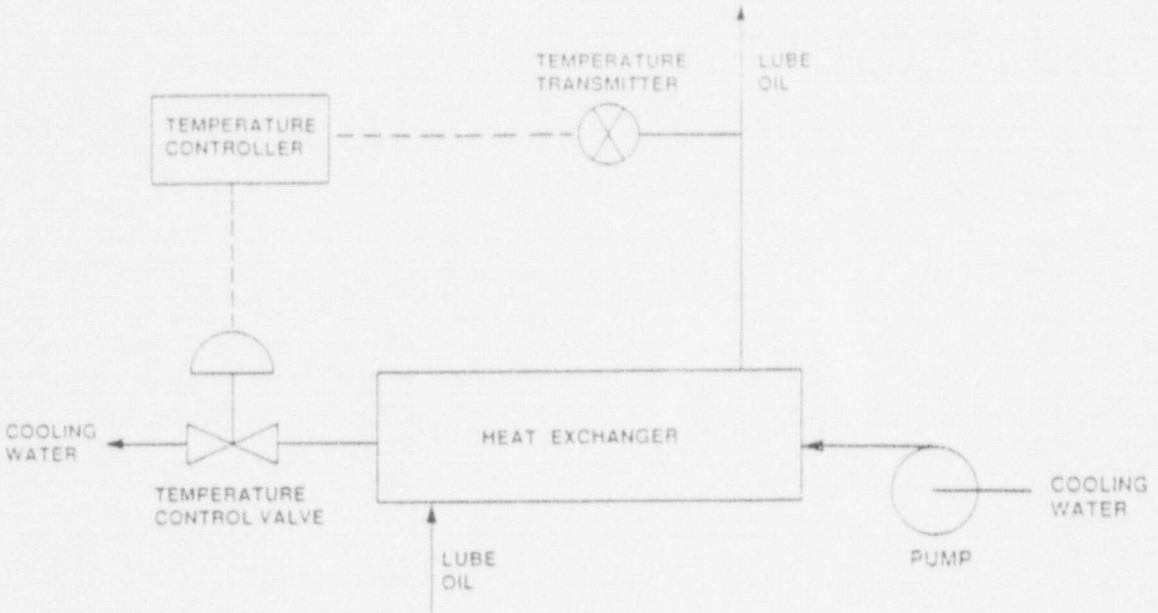
PNEUMATIC CONTROL SYSTEM - PWR

FIGURE 4

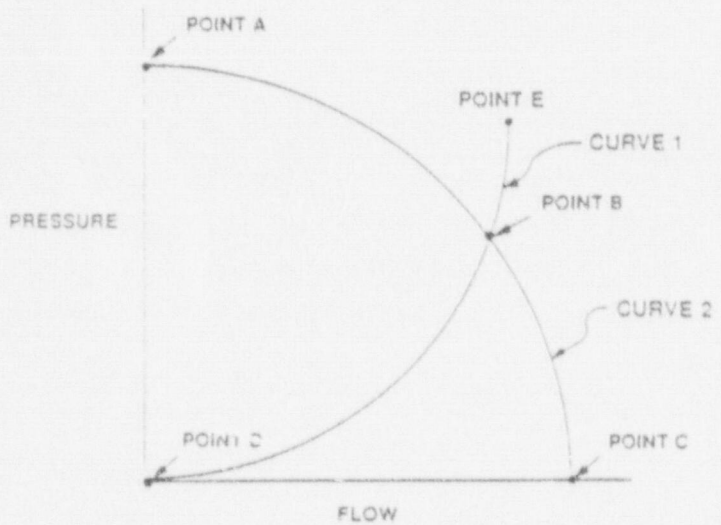


LUBE OIL TEMPERATURE CONTROL SYSTEM

FIGURE 5

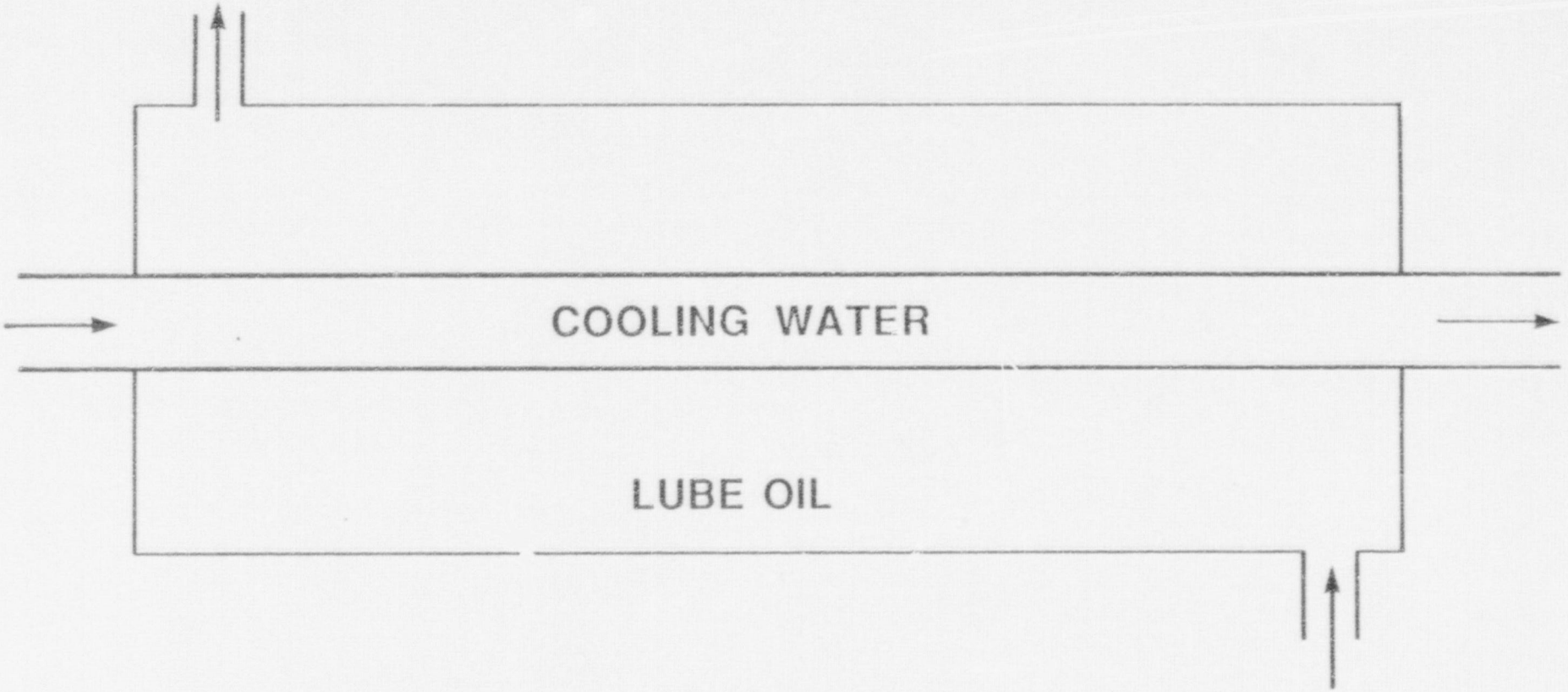


LUBE OIL TEMPERATURE CONTROL SYSTEM



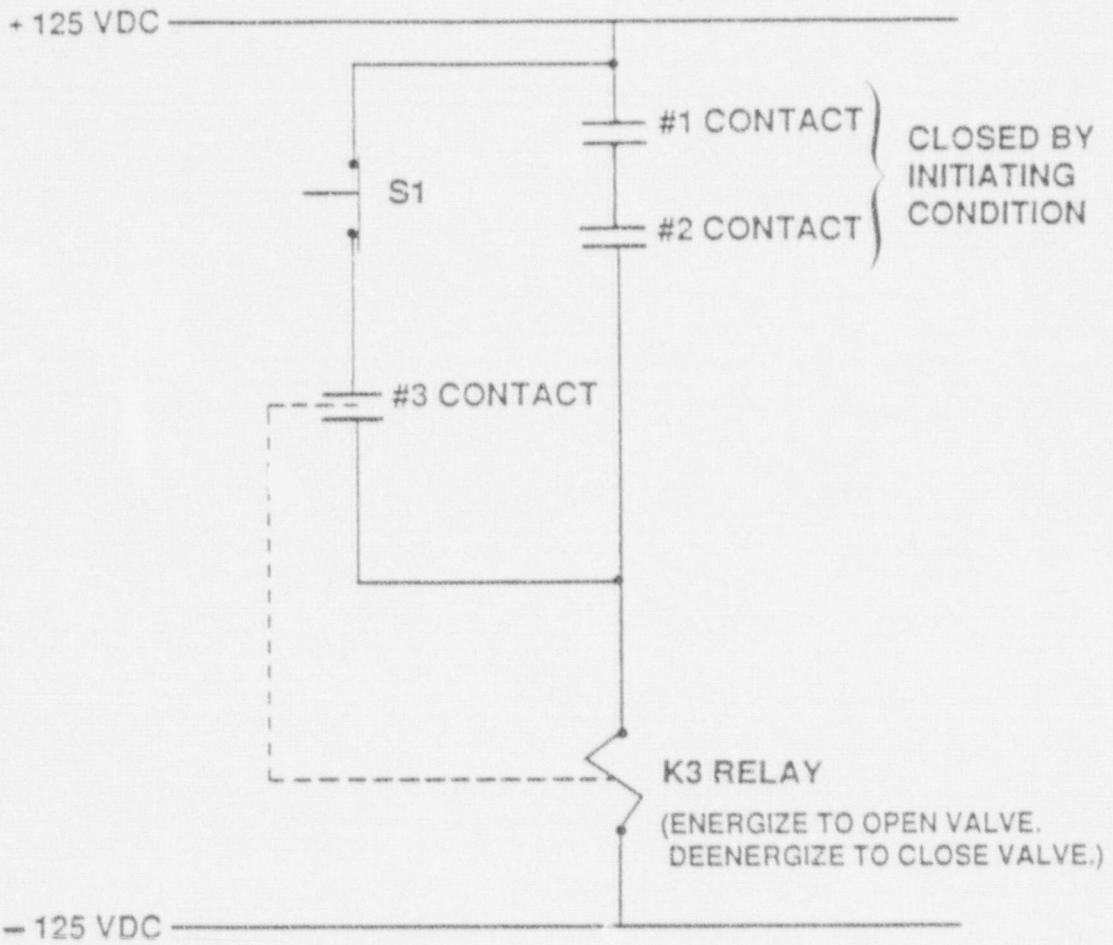
CENTRIFUGAL PUMP OPERATING CURVE

FIGURE 6



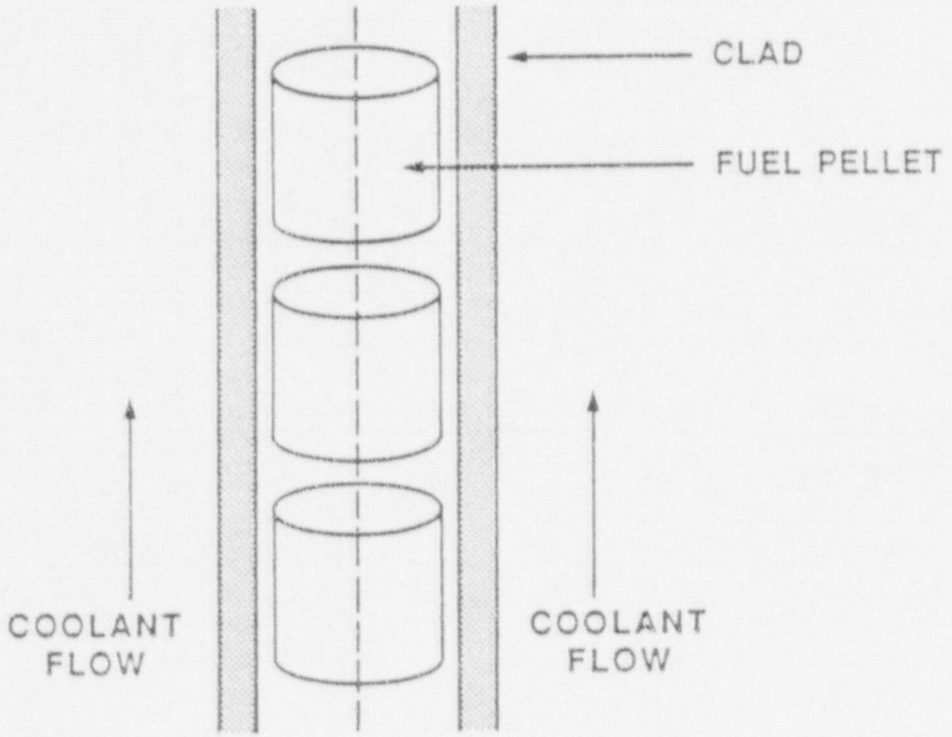
LUBE OIL HEAT EXCHANGER

FIGURE 7



TYPICAL VALVE CONTROL CIRCUIT

FIGURE 8



FUEL ROD AND COOLANT FLOW CHANNEL

FIGURE 9

USNRC GENERIC FUNDAMENTALS EXAMINATION
PWR - FORM A

QUESTION: 1

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

A. blowdown.

B. accumulation.

C. setpoint tolerance.

D. setpoint deviation.

QUESTION: 2

In comparison to a globe valve, a gate valve has a _____ pressure drop when fully open and is the _____ choice for throttling.

A. higher; better

B. lower; better

C. higher; poorer

D. lower; poorer

QUESTION: 3

When manually positioning a motor-operated valve, why must care be taken to avoid using excessive valve seating/backseating force?

A. Limit switch settings may change.

B. The valve may not operate on demand.

C. The motor may not re-engage.

D. Torque switch settings may change.

QUESTION: 4

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: 5

Density compensation is used in flow instruments to change _____ to _____.

A. mass flow rate; volumetric flow rate

B. volumetric flow rate; mass flow rate

C. mass flow rate; differential pressure

D. differential pressure; volumetric 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 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: 7

The flow rate of a fluid passing through a venturi can be determined by measuring the:

A. differential pressure of the fluid as it passes through the venturi.

B. linear displacement of a metering plug installed in the throat of the venturi.

C. change in the velocity of the fluid as it passes through the venturi.

D. rotation of a paddle wheel type device installed in the throat of the venturi.

QUESTION: 8

Refer to the drawing of two tank differential pressure level indicators (see figure 1).

Two differential pressure (D/P) level indicators are installed on a large water storage tank. Indicator 1 was calibrated at 100 degrees F water temperature and indicator 2 was calibrated at 200 degrees F water temperature. Assuming both are on scale, which indicator will indicate the higher level?

A. Indicator 1 at all water temperatures

B. Indicator 2 at all water temperatures

C. Indicator 1 below 150 degrees F, indicator 2 above 150 degrees F

D. Indicator 2 below 150 degrees F, indicator 1 above 150 degrees F

QUESTION: 9

Refer to the drawing of four tank differential pressure level detectors (see figure 2).

The tanks are identical with equal water levels and both are pressurized to 20 psig. All detectors were calibrated at the current water temperature and 70 degrees F external (ambient) temperature.

Which detectors will provide the MOST INACCURATE level indication following an increase in external (ambient) temperature from 70 degrees F to 100 degrees F? (Assume water temperature and external pressure do not change.)

A. 1 and 3

B. 2 and 4

C. 1 and 4

D. 2 and 3

QUESTION: 10

If the pressure sensed by a bourdon tube increases, the curvature of the detector will _____ because of the greatest force being applied to the _____ curve of the detector.

A. increase; inner

B. decrease; inner

C. increase; outer

D. decrease; outer

QUESTION: 11

A bellows pressure transmitter with its low-pressure side vented to containment atmosphere is being used to measure Reactor Coolant System (RCS) pressure. A decrease in the associated pressure indication could be caused by either a containment pressure _____ or a RCS pressure _____.

A. decrease; decrease

B. increase; increase

C. decrease; increase

D. increase; decrease

QUESTION: 12

A resistance temperature detector (RTD) operates on the principle that the change in metal resistance is _____ proportional to the change in _____.

A. inversely; metal temperature

B. inversely; metal temperature squared

C. directly; metal temperature

D. directly; metal temperature squared

QUESTION: 13

The plant has experienced a loss of coolant accident with degraded safety injection flow. The reactor coolant pumps have been manually tripped and the resulting phase separation has caused partial core uncovery (approximately 20 percent).

Which one of the following describes excore source/startup range neutron level indication as core uncovery increases from 20 percent to 100 percent of the core? (Assume neutron detectors are located adjacent to the bottom portion of the core.)

A. Increases continuously

B. Increases, then decreases

C. Decreases continuously

D. Decreases, then increases

QUESTION: 14

Refer to the drawing of a gas-filled detector characteristic curve (see figure 3).

Which of the following statements describes how a gas-filled radiation detector, operating in the "proportional" region, functions?

A. Essentially all of the ions caused by incident radiation are collected. Ions collected from secondary ionizations are independent of applied voltage.

B. Essentially none of the ions caused by incident radiation are collected. Ions collected from secondary ionizations vary directly with applied voltage.

C. Essentially all of the ions caused by incident radiation are collected. Ions collected from secondary ionizations vary directly with applied voltage.

D. Essentially none of the ions caused by incident are collected. Ions collected from secondary ionizations are independent of applied voltage.

QUESTION: 15

The difference between the setpoint and the measured parameter in an automatic flow controller is called:

A. gain.

B. bias.

C. feedback.

D. error.

QUESTION: 16

Refer to the drawing of a pneumatic control system (see figure 4).

Given that an increasing control signal from the Steam Generator Level Control System causes the I/P converter to modulate open, if the control signal is manually increased, how will the pneumatic control system affect steam generator level?

A. Level will increase because the valve positioner will open more.

B. Level will decrease because the valve positioner will open more.

C. Level will increase because the valve positioner will close more.

D. Level will decrease because the valve positioner will close more.

QUESTION: 17

Refer to the drawing of a lube oil temperature control system (see figure 5).

If the temperature transmitter fails HIGH (high temperature output signal), the temperature controller will _____ the temperature control valve, causing the actual heat exchanger oil outlet temperature to _____.

A. open; decrease

B. open; increase

C. close; decrease

D. close; increase

QUESTION: 18

What may be damaged if an operator attempts to manually disengage the motor on a motor-operated valve while the motor is operating?

A. Limit switches

B. Valve seat

C. Torque switches

D. Clutch

QUESTION: 19

Which one of the following describes the response of a direct acting proportional-integral 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: 20

Which of the following changes in pump operating parameters will DIRECTLY lead to pump cavitation in a centrifugal pump that is operating at rated conditions in an open system?

A. Steadily increasing pump inlet temperature

B. Steadily decreasing pump speed

C. Steadily increasing pump suction pressure

D. Steadily decreasing pump recirculation flow

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; maximum

D. minimum; minimum

QUESTION: 22

A centrifugal pump is circulating water at 100 degrees F in a cooling water system. After several hours the water temperature has increased to 150 degrees F. Assuming system flow rate (gpm) is constant, pump motor amps will have _____ because _____.

A. decreased; water density has decreased

B. increased; water density has decreased

C. decreased; pump shaft speed has increased

D. increased; pump shaft speed has increased

QUESTION: 23

Refer to the drawing of a lube oil temperature control system and the associated centrifugal pump operating curve (see figure 6).

If the pump is operating at point B on the operating curve, how will the operating point change if the temperature control valve modulates further open?

A. Operating point B will be located on curve 1 closer to point D.

B. Operating point B will be located on curve 2 closer to point A.

C. Operating point B will be located on curve 1 closer to point E.

D. Operating point B will be located on curve 2 closer to point C.

QUESTION: 24

Which one of the following specifies the proper pump discharge valve position and the basis for that position when starting a large centrifugal pump?

A. Discharge valve fully open to ensure proper axial alignment of pump impeller.

B. Discharge valve throttled to reduce motor power requirements

C. Discharge valve fully open to ensure adequate pump recirculation flow

D. Discharge valve throttled to lessen the possibility of air binding the pump

QUESTION: 25

If the speed of a positive displacement pump is increased, the available net positive suction head (NPSH) will _____ and the probability of cavitation will _____.

A. increase; increase

B. decrease; decrease

C. increase; decrease

D. decrease; increase

QUESTION: 26

Why are positive displacement and centrifugal pumps typically NOT operated in parallel?

A. At high system flow rates the positive displacement pump may not receive adequate net positive suction head.

B. At low discharge pressures the positive displacement pump may overheat from a lack of recirculation flow.

C. At high discharge pressures the positive displacement pump may prevent flow through the centrifugal pump.

D. Cyclic stresses may be placed on each pump due to uneven or oscillating pump flow rates.

QUESTION: 27

An operator can differentiate a locked reactor coolant pump (RCP) rotor from a sheared RCP rotor 30 seconds after the event by observing: (Assume no operator action.)

A. loop flow indications.

B. RCP ammeter indications.

C. loop differential temperature indications.

D. reactor trip status.

QUESTION: 28

If the generator bearings on a motor-generator begin to fail from overheating, then:

A. generator current will increase.

B. generator windings will overheat.

C. motor current will decrease.

D. motor windings will overheat.

QUESTION: 29

A main generator is operating on the grid with the following indications:

- 100 MWe
- 0 MVAR
- 2,900 amps
- 20,000 volts

If main generator excitation is reduced, amps will _____ and MWe will _____.

A. decrease; decrease

B. increase; decrease

C. decrease; remain the same

D. increase; remain the same

QUESTION: 30

A motor-driven centrifugal pump is operating at a low flow condition in an open system. The throttled discharge valve is then fully opened to increase system flow rate.

Which one of the following will increase?

A. Pump discharge pressure

B. Available net positive suction head

C. Motor amps

D. Pump speed

QUESTION: 31

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

A. starting torque is lower than running torque.

B. starting torque is higher than running torque.

C. rotor current during start is too low to generate sufficient counter electromotive force (CEMF) in the stator.

D. rotor current during start is too high to generate sufficient counter electromotive force (CEMF) in the stator.

QUESTION: 32

Refer to the drawing of a lube oil heat exchanger (see figure 7).

Decreasing the oil flow rate through the heat exchanger will cause the oil outlet temperature to _____ and the cooling water outlet temperature to _____. (Assume cooling water flow rate remains the same.)

A. decrease; decrease

B. increase; decrease

C. decrease; increase

D. increase; increase

QUESTION: 33

Tube fouling in a heat exchanger causes heat transfer rate to decrease by:

A. reducing fluid velocity on the shell side of the exchanger and reducing heat transfer area.

B. increasing flow rate through the tube side of the exchanger and increasing heat transfer area.

C. reducing the overall heat transfer coefficient and reducing tube side flow.

D. increasing the overall heat transfer coefficient and increasing shell side flow.

QUESTION: 34

During normal plant operation at power, a crack in the shell of the main condenser, that results in a decreased condenser vacuum, 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

How does demineralizer differential pressure indicate the condition of the demineralizer resin bed?

A. Low differential pressure indicates flow blockage in the demineralizer.

B. High differential pressure indicates flow blockage in the demineralizer.

C. Low differential pressure indicates that the demineralizer resin bed is exhausted.

D. High differential pressure indicates that the demineralizer resin bed is exhausted.

QUESTION: 36

Prior to a scheduled plant shutdown, the Reactor Coolant System was chemically shocked to induce a crud burst. What effect will this have on the letdown purification demineralizers?

A. Decreased operating time before the resin is exhausted

B. Increased flow rate through the demineralizers

C. Decreased demineralizer outlet conductivity

D. Increased pressure drop across the demineralizers

QUESTION: 37

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

A. increase the ion exchange rate for hydronium ions, thereby changing effluent pH.

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

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

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

QUESTION: 38

Which of the following results from a loss of circuit breaker control power to a circuit breaker supplying a motor?

A. Motor ammeter indication would be zero regardless of actual breaker position.

B. Breaker position would remotely indicate closed regardless of actual position.

C. Breaker would trip open due to the actuation of its protective trip device.

D. Close spring charging motor would not charge the spring following local tripping of the breaker.

QUESTION: 39

How is circuit breaker operation affected when the circuit breaker control power transfer switch is placed in the LOCAL position?

A. Control power will be available to provide protective trips and the circuit breaker can be closed by pushing the close pushbutton on or inside the circuit breaker enclosure.

B. Control power will be removed from the close circuits but control power will still be available for automatic circuit breaker trips.

C. Control power will be removed from both the open and close circuits and breaker operation is restricted to local manual operation only.

D. Control power will be removed from both the open and close circuits and the circuit breaker can be closed by pushing the close pushbutton on or inside the circuit breaker enclosure.

QUESTION: 40

Refer to the drawing of a typical valve control circuit (see figure 8).

The purpose of the K3 relay is to:

A. hold the valve open after one or both of the initiating conditions have cleared, even if the reset pushbutton (S1) is depressed.

B. hold the valve open even if one or both of the initiating conditions have cleared.

C. close the valve as soon as either initiating condition has cleared.

D. close the valve as soon as both initiating conditions have cleared.

QUESTION: 41

During paralleling operations of the main generator to the grid, closing the generator output breaker with the frequency of the generator at 60.1 hertz and the grid frequency at 60.0 hertz will:

A. cause the generator to immediately increase load.

B. trip open the generator breaker on reverse power.

C. cause the generator voltage to increase.

D. cause the generator current to decrease.

QUESTION: 42

When a typical 4160 volt breaker is racked to the TEST position control power is _____ the breaker and the breaker is _____ the load.

A. removed from; isolated from

B. removed from; connected to

C. available to; isolated from

D. available to; connected to

QUESTION: 43

The function of high voltage electrical disconnects is to provide _____ electrical isolation of equipment during _____ conditions.

A. manual; no-load

B. manual; overload

C. automatic; no-load

D. automatic; overload

QUESTION: 44

The following remote indications are observed for a 480 VAC load supply breaker. (The breaker is normally open.)

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. Closed and racked in

C. Open and racked to "test" position

D. Closed and racked to "test" position

QUESTION: 45

As compared to a prompt neutron, a delayed neutron is more likely to:

A. cause fast fission in the reactor fuel.

B. be resonantly absorbed in the reactor fuel.

C. cause thermal fission in the reactor fuel.

D. be detected by excore nuclear instrumentation.

QUESTION: 46

Select the equation that defines K-excess (excess reactivity).

A. $K_{eff} + 1$

B. $K_{eff} - 1$

C. $K_{eff}(1-SDM)$

D. $1/(1-K_{eff})$

QUESTION: 47

At the time of a reactor trip from 100 percent power, shutdown margin was determined to be -5.883% delta-K/K. Over the next 72 hours the Reactor Coolant System was cooled down and boron concentration was increased. The reactivities affected by the change in plant conditions are as follows:

Reactivity	Change (+ or -)
Xenon	2.675% delta-K/K
Moderator temperature	0.5% delta-K/K
Boron	1.04% delta-K/K

What is the shutdown margin 72 hours after the trip? (Assume end of core life.)

A. -1.668% delta-K/K

B. -3.748% delta-K/K

C. -7.018% delta-K/K

D. -9.098% delta-K/K

QUESTION: 48

Reactor power increases from 10^{-8} amps to 5×10^{-7} amps in 2 minutes. What is the average startup rate?

A. 0.95 dpm

B. 0.90 dpm

C. 0.85 dpm

D. 0.82 dpm

QUESTION: 49

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. smaller; faster

B. smaller; slower

C. larger; faster

D. larger; slower

QUESTION: 50

Which one of the following isotopes is the MOST significant contributor to resonance capture of fission neutrons in the reactor core?

A. U-233

B. U-238

C. Pu-239

D. Pu-240

QUESTION: 51

Which one of the following will cause the Doppler power coefficient to become MORE negative?

A. Increased clad creep

B. Increased pellet swell

C. Lower power level

D. Lower coolant boron concentration

QUESTION: 52

Which one of the following reactivity coefficients is the LARGEST contributor to the total power coefficient at the beginning of core life?

A. Moderator temperature coefficient

B. Void coefficient

C. Pressure coefficient

D. Doppler coefficient

QUESTION: 53

The amount of boric acid required to increase the reactor coolant boron concentration by 10 ppm at beginning of core life conditions (1200 ppm) is approximately _____ the amount of boric acid required to increase boron concentration by 10 ppm at end of core life conditions (100 ppm).

A. twelve times

B. eight times

C. four times

D. the same as

QUESTION: 54

Integral control rod (CEA) worth is the change in _____ per _____ change in rod (CEA) position.

A. reactor power; total

B. reactivity; unit

C. reactor power; unit

D. reactivity; total

QUESTION: 55

Which one of the following parameters typically has the GREATEST effect on the shape of a differential rod worth curve?

A. Core radial flux distribution

B. Core axial flux distribution

C. Core xenon distribution

D. Burnable poison distribution

QUESTION: 56

The purposes of using control rod (CEA) bank overlap are to:

A. ensure the rod (CEA) insertion limits are not exceeded and to maintain individual and group rod (CEA) position within allowable tolerances.

B. provide a more uniform differential rod (CEA) worth and to ensure the rod (CEA) insertion limits are not exceeded.

C. provide a more uniform axial flux distribution and to provide a more uniform differential rod (CEA) worth.

D. maintain individual and group rod (CEA) position indicators within allowable tolerances and to provide a more uniform axial flux distribution.

QUESTION: 57

The reactor is operating at 80 percent power during a load decrease to 60 percent when a control rod (CEA) becomes stuck during insertion of the rest of its group. If group control rod insertion continues, which of the following will be adversely affected?

A. Power distribution and shutdown margin

B. Shutdown margin and power defect

C. Power defect and critical heat flux

D. Critical heat flux and power distribution

QUESTION: 58

Xenon-135 is considered a major fission product poison because it has a large:

A. fission cross section.

B. absorption cross section.

C. elastic scatter cross section.

D. inelastic scatter cross section.

QUESTION: 59

A reactor has been operating at a steady-state power level for 15 hours following a rapid power reduction from 100 to 50 percent using boration for reactivity control. Which one of the following describes the current core xenon concentration?

A. Increasing

B. Decreasing

C. At equilibrium

D. Oscillating

QUESTION: 60

A reactor has been operating at 100 percent power for one week when power is ramped in 4 hours to 50 percent. Which statement describes the new equilibrium xenon concentration?

A. One-half the 100 percent value

B. Less than one-half the 100 percent value

C. More than one-half the 100 percent value

D. Equal to the 100 percent value

QUESTION: 61

Xenon oscillations that tend to DAMPEN themselves toward equilibrium over time are _____ oscillations.

A. converging

B. diverging

C. diffusing

D. transitioning

QUESTION: 62

Following a 7 day shutdown, a reactor startup is performed and the plant is taken to 40 percent power over a 6 hour period. After stabilizing at 40 percent power, what type of reactivity will the operator need to add to compensate for xenon changes over the next 24 hours?

A. Negative only

B. Negative, then positive

C. Positive, then negative

D. Positive only

QUESTION: 63

Following a reactor trip, negative reactivity from xenon initially increases due to:

A. xenon production from the decay of iodine-135.

B. xenon production from the spontaneous fission of uranium.

C. the reduction of xenon removal by decay.

D. the reduction of xenon removal by recombination.

QUESTION: 64

During a six-month period of continuous full power reactor operation, the reactor coolant boron concentration must be decreased steadily to compensate for:

A. buildup of fission product poisons and decreasing control rod (CEA) worth.

B. fuel depletion and buildup of fission product poisons.

C. decreasing control rod (CEA) worth and burnable poison burnout.

D. burnable poison burnout and fuel depletion.

QUESTION: 65

While withdrawing control rods (CEAs) during an approach to criticality, the stable count rate doubles. If the same amount of reactivity that caused the first doubling is added again, stable count rate will _____ and the reactor will be _____.

A. double; subcritical

B. more than double; subcritical

C. double; critical

D. more than double; critical

QUESTION: 66

During a reactor startup, control rods (CEAs) are withdrawn such that K_{eff} increases from 0.98 to 0.99. If the count rate before the rod withdrawal was 500 cps, which one of the following will be the final count rate?

A. 750 cps

B. 1000 cps

C. 1500 cps

D. 2000 cps

QUESTION: 67

An estimated critical rod position (ECP) has been calculated for a reactor startup that is to be performed 6 hours after a trip from a 60 day full power run. Which one of the following events or conditions will result in the actual critical rod position being LOWER than the ECP?

A. The startup is delayed for approximately 2 hours.

B. The steam generator pressures are decreased by 100 psi just prior to criticality.

C. A new boron sample shows a current boron concentration 20 ppm higher than that used in the ECP calculation.

D. Steam generator feedwater addition rate is reduced by 5 percent just prior to criticality.

QUESTION: 68

The reactor is critical at 10,000 cps when a steam generator atmospheric relief valve fails open. Assume end of core life conditions, no reactor trip, and no operator actions are taken.

When the reactor stabilizes, Tave will be _____ than the initial Tave and reactor power will be _____ the point of adding heat.

A. greater; at

B. greater; above

C. less; at

D. less; above

QUESTION: 69

During a xenon-free reactor startup, critical data were inadvertently taken one decade above the required intermediate range (IR) level. The critical data were taken again at the proper IR level with the same reactor coolant temperatures and boron concentration.

The critical rod (CEA) position taken at the proper IR level is _____ the critical rod position taken one decade above the proper IR level.

A. less than

B. the same as

C. greater than

D. unrelated to

QUESTION: 70

After taking critical data during a reactor startup, the operator establishes a stable 1 dpm startup rate to increase power to the point of adding heat (POAH). How much negative reactivity feedback must be added at the POAH to stop the power increase?

Assume: $\bar{\beta}_{\text{eff}} = 0.00579$
$l = 1.0 \times 10^{-5}$ sec
$\lambda_{\text{eff}} = 0.1$ sec^{-1}

A. 0.16% delta-k/k

B. 0.19% delta-k/k

C. 0.23% delta-k/k

D. 0.29% delta-k/k

QUESTION: 71

The use of boron as a burnable poison in a reactor core:

A. increases the amount of fuel required to produce the same amount of heat.

B. allows the plant to operate longer on a smaller amount of fuel.

C. allows more fuel to be loaded and prolongs core life.

D. absorbs neutrons that would otherwise be lost from the core.

QUESTION: 72

The reactor is exactly critical below the point of adding heat when a single control rod (CEA) is fully inserted into the core. Assuming no operator or automatic action, reactor power will slowly decrease to:

A. zero.

B. the value associated with the source neutron strength.

C. a value above the source neutron strength.

D. a slightly lower value, then slowly increase to the initial value.

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. 13.5 psia

D. 14.0 psia

QUESTION: 74

A liquid is saturated with 0 percent quality. Assuming pressure remains constant, the addition of a small amount of heat will:

A. raise the liquid temperature above the boiling point.

B. result in a subcooled liquid.

C. result in vaporization of the liquid.

D. result in a superheated liquid.

QUESTION: 75

Which one of the following steam generator (S/G) pressures will come closest to producing a 50 degree F reactor coolant system (RCS) subcooling margin with RCS pressure at 1000 psia? (Assume a negligible delta-T across the S/G tubes.)

A. 550 psia

B. 600 psia

C. 650 psia

D. 700 psia

QUESTION: 76

Which one of the following explains why condensate subcooling is necessary in the steam turbine/condenser phase of a plant cycle?

A. To maximize overall secondary efficiency

B. To provide a better condenser vacuum

C. To minimize turbine blade and condenser tube erosion by entrained moisture

D. To provide net positive suction head for the condensate pumps

QUESTION: 77

You are involved in a routine plant shutdown with a steam bubble in the pressurizer. Pressurizer pressure is 415 psig and pressurizer pressure and level are slowly decreasing. You suspect a pressurizer power operated relief valve (PORV) is partially open but the position indicating lights are not working.

Which one of the following is the expected PORV tailpipe temperature if the PORV is open? (Assume downstream pressure is atmospheric.)

A. 652 degrees F

B. 450 degrees F

C. 330 degrees F

D. 212 degrees F

QUESTION: 78

To achieve maximum plant efficiency, feedwater should enter the steam generator (S/G) _____ and the temperature difference between the S/G and the condenser should be as _____ as possible.

A. close to saturation; small

B. close to saturation; great

C. as subcooled as practical; small

D. as subcooled as practical; great

QUESTION: 79

A sudden stop of fluid flow in a piping system, due to rapid closure of an isolation valve, will most likely result in:

A. check valve slamming.

B. pump runout.

C. water hammer.

D. pressurized thermal shock.

QUESTION: 80

A 55 gpm leak has developed in a cooling water system that is operating at 100 psig. Which one of the following is the expected leak rate when system pressure has decreased to 50 psig?

A. 27.5 gpm

B. 31.8 gpm

C. 38.9 gpm

D. 43.4 gpm

QUESTION: 81

Cavitation of a centrifugal pump in an open system is indicated by _____ discharge pressure and _____ flow rate.

A. low; low

B. high; high

C. low; high

D. high; low

QUESTION: 82

In an operating cooling water system with a constant water velocity, if water temperature decreases, indicated volumetric flow rate (gpm) will:

A. remain the same, because the density of the water has not changed.

B. increase, because the density of the water has increased.

C. remain the same, because the water velocity has not changed.

D. increase, because the viscosity of the water has increased.

QUESTION: 83

To decrease the flow rate through an operating positive displacement pump, an operator should:

A. throttle the pump discharge valve partially closed.

B. throttle the pump suction valve partially closed.

C. decrease the pump NPSH.

D. decrease the pump speed.

QUESTION: 84

Refer to the drawing of a fuel rod and coolant flow channel at beginning of core life (see figure 9).

Given the following initial core parameters:

Reactor power = 100 percent
$T_{coolant}$ = 500 degrees F
$T_{fuel\ centerline}$ = 3000 degrees F

What would the fuel centerline temperature be if, over core life, the total fuel-to-coolant thermal conductivity were doubled? (Assume reactor power is constant.)

A. 1000 degrees F

B. 1250 degrees F

C. 1500 degrees F

D. 1750 degrees F

QUESTION: 85

The reactor is operating at 80 percent power with a core delta-T of 48 degrees F when a station blackout occurs. Natural circulation is established and core delta-T stabilizes at 40 degrees F. If mass flow rate is 3.0 percent, what is the current decay heat level?

A. 1.0 percent

B. 2.0 percent

C. 3.0 percent

D. 4.0 percent

QUESTION: 86

Subcooled nucleate boiling is occurring along a heated surface. The heat flux is then increased slightly. What will be the effect on the delta-T between the surface and the fluid? (Assume subcooled nucleate boiling is still occurring.)

A. Large increase in delta-T because of steam blanketing

B. Large increase in delta-T causing radiative heat transfer to become significant

C. Small increase in delta-T because of steam blanketing

D. Small increase in delta-T as vapor bubbles form and collapse

QUESTION: 87

Which parameter change will reduce the departure from nucleate boiling ratio (DNBR)?

A. Decrease in reactor power

B. Increase in pressurizer pressure

C. Increase in reactor coolant flow

D. Increase in reactor coolant temperature

QUESTION: 88

How does critical heat flux vary from the bottom to the top of the reactor core during normal full power operation?

A. Decreases continuously

B. Decreases then increases

C. Increases continuously

D. Increases then decreases

QUESTION: 89

A small increase in delta-T (at the fuel clad-to-coolant interface) causes increased steam blanketing and a reduction in heat flux. This describes which type of boiling?

A. Subcooled boiling

B. Nucleate boiling

C. Partial film boiling

D. Total film boiling

QUESTION: 90

The heat transfer coefficient of the core will be directly increased if: (Assume bulk coolant subcooling.)

A. the coolant temperature is decreased.

B. the coolant flow rate is decreased.

C. nucleate boiling occurs in the coolant.

D. the coolant flow is laminar instead of turbulent.

QUESTION: 91

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

A. Emergency cooling injection flow rate

B. Pressurizer level

C. Subcooling margin

D. Pressurizer pressure

QUESTION: 92

During a plant cooldown and depressurization with forced circulation, Reactor Coolant System (RCS) loop flow and reactor coolant pump (RCP) current indications become erratic. This is most likely caused by:

A. RCP cavitation.

B. RCP runout.

C. RCS loop water hammer.

D. RCS hot leg saturation.

QUESTION: 93

With the Reactor Coolant System subcooled and all reactor coolant pumps stopped, the stable natural circulation flow rate will NOT be affected by an increase in the:

A. reactor coolant pressure.

B. time after reactor trip.

C. steam generator level.

D. steam generator pressure.

QUESTION: 94

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 oxidation 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: 95

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: 96

Pressure stress on the reactor vessel wall is:

A. compressive across the entire wall.

B. tensile across the entire wall.

C. tensile at the inner wall, compressive at the outer wall.

D. compressive at the inner wall, tensile at the outer wall.

QUESTION: 97

The reference temperature for nil-ductility transition (RT_{NDT}) is the temperature above which:

A. a large compressive stress can result in brittle fracture.

B. a metal exhibits more ductile tendencies.

C. the probability of brittle fracture increases.

D. no appreciable deformation occurs prior to failure.

QUESTION: 98

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

A. oxygen content in the reactor 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

Which one of the following types of radiation significantly reduces the ductility of the metal of a reactor pressure vessel?

A. Beta

B. Thermal neutrons

C. Gamma

D. Fast neutrons

QUESTION: 100

Pressurized thermal shock would most likely be a concern during an uncontrolled:

A. cooldown followed by a rapid repressurization.

B. depressurization followed by a rapid repressurization.

C. cooldown followed by a rapid depressurization.

D. depressurization followed by a rapid cooldown.