TOPIC: 292008
KNOWLEDGE: K1.02 [3.8/3.8]
QID: B1065

A refueling outage has just been completed, and a reactor startup is being commenced. Which one of the following lists the method(s) typically used to add positive reactivity during the approach to criticality?

A. Control rods only

B. Recirculation flow only

C. Control rods and recirculation flow

D. Recirculation flow and steaming rate

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B266 (P65)

While withdrawing control rods during a reactor startup, the stable source range count rate doubled. If the same amount of reactivity that caused the first doubling is added again, the stable count rate will ___________; and the reactor will be ___________.

A. more than double; subcritical

B. more than double; critical

C. double; subcritical

D. double; critical

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B1449 (P1348)

A reactor is shut down by 1.8 %ΔK/K. Positive reactivity is added that increases the stable source range count rate from 15 cps to 300 cps.

What is the current value of K_{eff}?

A. 0.982

B. 0.990

C. 0.995

D. 0.999

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B1565 (P1065)

During a reactor startup, equal amounts of positive reactivity are being sequentially added, and the source range count rate is allowed to reach equilibrium after each addition. Which one of the following statements applies for each successive reactivity addition?

A. The time required to reach equilibrium count rate is the same.

B. The time required to reach equilibrium count rate is shorter.

C. The numerical change in equilibrium count rate is greater.

D. The numerical change in equilibrium count rate is the same.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B1766 (P2468)

A reactor startup is in progress with a current K_{eff} of 0.95 and a stable source range count rate of 150 cps. Which one of the following stable count rates will occur when K_{eff} becomes 0.98?

A. 210 cps

B. 245 cps

C. 300 cps

D. 375 cps

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B1849 (P1448)

A subcritical reactor has a stable source range count rate of 150 cps with a shutdown reactivity of -2.0 %ΔK/K. Approximately how much positive reactivity must be added to establish a stable count rate of 600 cps?

A. 0.5 %ΔK/K

B. 1.0 %ΔK/K

C. 1.5 %ΔK/K

D. 2.0 %ΔK/K

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B1949 (P448)

A subcritical reactor has a stable source range count rate of 150 cps with a shutdown reactivity of −2.0 %ΔK/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

A. 0.5 %ΔK/K

B. 1.0 %ΔK/K

C. 1.5 %ΔK/K

D. 2.0 %ΔK/K

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B1964

A reactor startup is in progress and the reactor is slightly subcritical with a stable source range count rate. Assuming the reactor remains subcritical, a short control rod withdrawal will cause the reactor period to become positive, and then...

A. gradually lengthen and stabilize at a negative 80-second period.

B. gradually lengthen and stabilize at infinity.

C. gradually lengthen until reactor power reaches the point of adding heat, then stabilize at infinity.

D. gradually lengthen until the neutron population reaches equilibrium, then stabilize at a negative 80-second period.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2069

A reactor startup is in progress with a current K_{eff} of 0.95 and a stable source range count rate of 120 cps. Which one of the following stable count rates will occur when K_{eff} becomes 0.98?

A. 210 cps

B. 245 cps

C. 300 cps

D. 375 cps

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2149 (P848)

A subcritical reactor has an initial K_{eff} of 0.8 with a stable source range count rate of 100 cps. If positive reactivity is added until K_{eff} equals 0.95, at what value will the count rate stabilize?

A. 150 cps

B. 200 cps

C. 300 cps

D. 400 cps

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2165 (P1766)

A reactor startup is in progress with the reactor currently subcritical.

Which one of the following describes the change in source range count rate resulting from a short control rod withdrawal with K_{eff} at 0.95 compared to an identical control rod withdrawal with K_{eff} at 0.98? (Assume the reactivity additions are equal and the reactor remains subcritical.)

A. Both the prompt jump in count rate and the increase in stable count rate will be the same for both values of K_{eff}.

B. Both the prompt jump in count rate and the increase in stable count rate will be smaller with K_{eff} at 0.95.

C. The prompt jump in count rate will be smaller with K_{eff} at 0.95, but the increase in stable count rates will be the same.

D. The prompt jump in count rates will be the same, but the increase in stable count rate will be smaller with K_{eff} at 0.95.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2365 (P2366)

A reactor startup is in progress with a current K_{eff} of 0.95 and a stable source range count rate of 120 cps. Which one of the following stable count rates will occur when K_{eff} becomes 0.97?

A. 200 cps

B. 245 cps

C. 300 cps

D. 375 cps

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2465 (P2466)

A reactor startup is being performed by adding equal amounts of positive reactivity and waiting for source range count rate to stabilize. As the reactor approaches criticality, the numerical change in stable count rate resulting from each reactivity addition will __________; and the time required for the count rate to stabilize after each reactivity addition will __________.

A. increase; remain the same

B. increase; increase

C. remain the same; remain the same

D. remain the same; increase

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2566

A reactor startup is in progress with a current K_{eff} of 0.95 and a stable source range count rate of 120 cps. Which one of the following stable count rates will occur when K_{eff} becomes 0.985?

A. 250 cps

B. 300 cps

C. 350 cps

D. 400 cps

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2649 (P2448)

A reactor startup is being performed with xenon-free conditions. Control rod withdrawal is stopped when K_{eff} equals 0.995 and source range count rate stabilizes at 1,000 cps. No additional operator actions are taken.

Which one of the following describes the count rate 20 minutes after rod withdrawal is stopped?

A. Less than 1,000 cps and decreasing toward the prestartup count rate.

B. Less than 1,000 cps and stable above the prestartup count rate.

C. Greater than 1,000 cps and increasing toward criticality.

D. 1,000 cps and constant.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B2949

A nuclear power plant is being cooled down from 400°F to 250°F. Just prior to commencing the cooldown, the stable source range count rate was 32 cps. When reactor coolant temperature is 300°F, the stable count rate is 64 cps.

Assuming the moderator temperature coefficient remains constant throughout the cooldown, what will be the status of the reactor when reactor coolant temperature reaches 250°F?

A. Subcritical, with a source range count rate below 150 cps.

B. Subcritical, with a source range count rate above 150 cps.

C. Critical, with a source range count rate below 150 cps.

D. Critical, with a source range count rate above 150 cps.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B3049 (P3048)

A reactor startup is being commenced with the initial source range count rate stable at 20 cps. After a period of control rod withdrawal, the count rate stabilizes at 80 cps.

If the total reactivity added by the above control rod withdrawal was 4.5 %ΔK/K, how much additional positive reactivity must be inserted to make the reactor critical?

A. 1.5 %ΔK/K

B. 2.0 %ΔK/K

C. 2.5 %ΔK/K

D. 3.0 %ΔK/K

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [3.8/3.9]
QID: B3365

A nuclear power plant was operating at steady-state 100 percent power near the end of a fuel cycle when a reactor scram occurred. Four hours after the scram, reactor pressure is currently being maintained at 600 psig in anticipation of commencing a reactor startup.

Which one of the following will cause the core fission rate to increase?

A. The operator fully withdraws the first group of control rods.

B. Reactor vessel pressure is allowed to increase by 20 psig.

C. Reactor coolant temperature is allowed to increase by 3°F.

D. An additional 2 hours are allowed to pass with no other changes in plant parameters.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [3.8/3.9]
QID: B3465

A nuclear power plant was operating at steady-state 100 percent power near the end of a fuel cycle when a reactor scram occurred. Four hours after the scram, reactor pressure is currently being maintained at 600 psig in anticipation of commencing a reactor startup.

Which one of the following will cause the core fission rate to decrease?

A. Core void fraction is decreased by 2 percent.

B. Reactor coolant temperature is allowed to decrease by 3°F.

C. The operator fully withdraws the first group of control rods.

D. An additional 2 hours are allowed to pass with no other changes in plant parameters.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B3925 (P3925)

A reactor startup is in progress with K_{eff} initially equal to 0.90. By what factor will the core neutron level increase if the reactor is stabilized when K_{eff} equals 0.99?

A. 10

B. 100

C. 1,000

D. 10,000

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B4225 (P4225)

A reactor is shutdown with a K_{eff} of 0.96 and a stable source range count rate of 50 cps when a reactor startup is commenced. Which one of the following will be the stable count rate when K_{eff} reaches 0.995?

A. 400 cps

B. 800 cps

C. 4,000 cps

D. 8,000 cps

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B4525 (P4525)

A nuclear power plant is being cooled down from 500°F to 190°F. Just prior to commencing the cooldown, the source range count rate was stable at 32 cps. After two hours, with reactor water temperature at 350°F, the source range count rate is stable at 64 cps.

Assume the moderator temperature coefficient remains constant throughout the cooldown and reactor power remains below the point of adding heat.

Without additional operator action, what will the status of the reactor be when reactor water temperature reaches 190°F?

A. Subcritical, with source range count rate below 150 cps.

B. Subcritical, with source range count rate above 150 cps.

C. Exactly critical.

D. Supercritical.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B4533

A reactor is critical in the source range during a reactor startup with a core effective delayed neutron fraction of 0.007. The operator then adds positive reactivity to establish a stable 60-second reactor period.

If the core effective delayed neutron fraction had been 0.005, what would the approximate stable reactor period be after the addition of the same amount of positive reactivity?

A. 28 seconds

B. 32 seconds

C. 36 seconds

D. 40 seconds

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B5225 (P5225)

Initially, a reactor was shut down with a stable source range count rate of 30 cps. Using many small positive reactivity additions, a total of 0.1 %ΔK/K was added to the reactor. Currently, the source range count rate is stable at 60 cps.

What was the stable source range count rate after only 0.05 %ΔK/K was added to the reactor during the above process?

A. 40 cps

B. 45 cps

C. 50 cps

D. 55 cps

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B5625

A reactor startup is in progress at a BWR nuclear power plant. The following stable conditions currently exist:

Reactor coolant temperature = 180°F
Control rod density = 50 percent
Source range count rate = 32 cps

Control rods are withdrawn to a control rod density of 45 percent, where the source range count rate stabilizes at 48 cps.

Assume that control rod differential reactivity worth remains constant during the withdrawal, reactor coolant temperature remains constant, and no reactor protection actuations occur.

If control rods are withdrawn further to a control rod density of 40 percent, what will be the status of the reactor?

A. Subcritical, with a stable source range count rate of approximately 64 cps.

B. Subcritical, with a stable source range count rate of approximately 96 cps.

C. Critical, with a stable source range count rate of approximately 64 cps.

D. Critical, with a stable source range count rate of approximately 96 cps.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B7433 (P5025)

Initially, a nuclear power plant was shut down with a K_{eff} of 0.92, and a stable source range count rate of 200 cps. Then, a reactor startup was initiated. All control rod motion was stopped when K_{eff} reached 0.995. The instant that control rod motion stopped, the source range count rate was 1,800 cps.

When the source range count rate stabilizes, the count rate will be approximately...

A. 1,800 cps

B. 3,200 cps

C. 3,400 cps

D. 5,000 cps

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B7627 (P7627)

Refer to the drawing that shows a graph of fission rate versus time (see figure below). Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, could cause the reactor response shown on the graph?

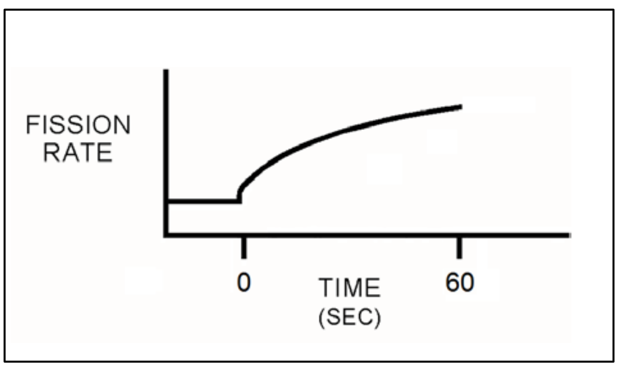
A. A step addition of positive reactivity to a reactor that is initially subcritical in the source range, and remains subcritical for the duration of the 60-second interval shown.

B. A step addition of positive reactivity to a reactor that is initially critical in the source range, and remains below the point of adding heat for the duration of the 60-second interval shown.

C. A continuous addition of positive reactivity at a constant rate to a reactor that is initially subcritical in the source range, and remains subcritical for the duration of the 60-second interval shown.

D. A continuous addition of positive reactivity at a constant rate to a reactor that is initially critical in the source range, and remains below the point of adding heat for the duration of the 60-second interval shown.

ANSWER: A.



TOPIC: 292008
KNOWLEDGE: K1.03 [4.1/4.0]
QID: B7668 (P7668)

At the beginning of a reactor startup, K_{eff} was 0.97 and the stable source range count rate was 40 cps. After several incremental control rod withdrawals, the stable source range count rate was 400 cps. The next incremental control rod withdrawal resulted in a stable source range count rate of 600 cps. What is the current K_{eff}?

A. 0.98

B. 0.988

C. 0.998

D. There is not enough information given to calculate the current K_{eff}.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B67

As a reactor approaches criticality during a reactor startup, it takes longer to reach a stable source range count rate after each control rod withdrawal due to the increased...

A. fraction of fission neutrons leaking from the core.

B. number of neutron generations required to reach a stable neutron level.

C. length of time from neutron generation to absorption.

D. fraction of delayed neutrons appearing as criticality is approached.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B365 (P365)

A reactor startup is in progress with a stable source range count rate and the reactor is near criticality. Which one of the following statements describes count rate characteristics during and after a 5-second control rod withdrawal? (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 original value.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B366 (P2265)

With K_{eff} at 0.95 during a reactor startup, source range indication is stable at 100 cps. After a number of control rods have been withdrawn, source range indication stabilizes at 270 cps. What is the current value of K_{eff}?

A. 0.963

B. 0.972

C. 0.981

D. 0.990

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B865

Which one of the following is a significant factor when calculating the critical rod position for a reactor startup?

A. Core flow rate

B. Source range initial count rate

C. Recirculation ratio

D. Core age

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B1067 (P1972)

With K_{eff} at 0.92 during a reactor startup, the stable source range count rate is noted to be 780 cps. Later in the same startup, the stable count rate is 4,160 cps.

What is the current value of K_{eff}?

A. 0.945

B. 0.950

C. 0.975

D. 0.985

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B1566 (P266)

During a reactor startup, the operator adds 1.0 %ΔK/K of positive reactivity by withdrawing control rods, thereby increasing the stable source range count rate from 220 cps to 440 cps.

Approximately how much additional positive reactivity is required to raise the stable count rate to 880 cps?

A. 4.0 %ΔK/K

B. 2.0 %ΔK/K

C. 1.0 %ΔK/K

D. 0.5 %ΔK/K

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B2167 (P1867)

During a reactor startup, the first reactivity addition caused the stable source range count rate to increase from 20 cps to 40 cps. The second reactivity addition caused the stable count rate to increase from 40 cps to 80 cps. K_{eff} was 0.92 prior to the first reactivity addition.

Which one of the following statements describes the magnitude of the reactivity additions?

A. The first reactivity addition was approximately twice as large as the second.

B. The second reactivity addition was approximately twice as large as the first.

C. The first and second reactivity additions were approximately the same.

D. There is not enough data given to determine the relationship between reactivity values.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B2249 (P2248)

Two reactors are currently shut down with reactor startups in progress. The reactors are identical except that reactor A has a source neutron strength of 100 neutrons per second and reactor B has a source neutron strength of 200 neutrons per second. The control rods are stationary and K_{eff} is 0.98 in both reactors. Core neutron levels have stabilized in both reactors.

Which one of the following lists the core neutron levels (neutrons per second) in reactors A and B?

	Reactor A (n/sec)	Reactor B (n/sec)
A.	5,000	10,000
B.	10,000	20,000
C.	10,000	40,000
D.	20,000	40,000

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B2266 (P1866)

As a reactor approaches criticality during a reactor startup, it takes longer to reach an equilibrium source range count rate after each control rod withdrawal due to the increased...

A. length of time required to complete a neutron generation.

B. number of neutron generations required to reach a stable neutron level.

C. length of time from neutron birth to absorption.

D. fraction of delayed fission neutrons being produced.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B2449

Two reactors are currently shut down with reactor startups in progress. The reactors are identical except that reactor A has a source neutron strength of 100 neutrons per second and reactor B has a source neutron strength of 80 neutrons per second. The control rods are stationary and K_{eff} is 0.98 in both reactors. Core neutron level has stabilized in both reactors.

Which one of the following lists the core neutron levels (neutrons per second) in reactors A and B?

	Reactor A (n/sec)	Reactor B (n/sec)
A.	5,000	4,000
B.	5,000	1,600
C.	2,000	1,600
D.	2,000	400

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B2765 (P2766)

With K_{eff} at 0.95 during a reactor startup, source range indication is stable at 120 cps. After a period of control rod withdrawal, source range indication stabilizes at 600 cps.

What is the current value of K_{eff}?

A. 0.96

B. 0.97

C. 0.98

D. 0.99

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B3849 (P3848)

A reactor is shutdown with a K_{eff} of 0.8. The source range count rate is stable at 800 cps. What percentage of the core neutron population is being contributed directly by neutron sources other than neutron-induced fission?

A. 10 percent

B. 20 percent

C. 80 percent

D. 100 percent

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B6134 (P6133)

A subcritical reactor has a stable source range count rate of 2.0×10^5 cps with a K_{eff} of 0.98. Positive reactivity is added to the core until a stable count rate of 5.0×10^5 cps is achieved. What is the current value of K_{eff}?

A. 0.984

B. 0.988

C. 0.992

D. 0.996

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B7233

A nuclear power plant is shutdown with the following stable initial conditions:

Reactor coolant temperature: 200°F
Reactor vessel pressure: 300 psia
Source range count rate: 140 cps

Control rods are withdrawn to commence a reactor startup. After 50 units of control rod withdrawal, the equilibrium source range count rate is 280 cps.

Assume that each unit of control rod withdrawal has the same reactivity worth. Also assume that the reactor coolant temperature remains constant, reactor power remains below the point of adding heat, and no reactor protection actuations occur.

What will be the status of the reactor after the control rods are withdrawn a total of 75 units?

A. Subcritical, with equilibrium source range count rate less than 600 cps.

B. Subcritical, with equilibrium source range count rate greater than 600 cps.

C. Critical, with equilibrium source range count rate less than 600 cps.

D. Critical, with equilibrium source range count rate greater than 600 cps.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B7628 (P7628)

A reactor is shutdown with a K_{eff} of 0.8. The source range count rate is stable at 800 cps. What percentage of the core neutron population is being contributed directly by neutron-induced fission?

A. 10 percent

B. 20 percent

C. 80 percent

D. 100 percent

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B7638 (P4734)

During a reactor startup, positive reactivity addition X caused the stable source range count rate to increase from 20 cps to 40 cps. Later in the startup, after several more additions of positive reactivity, positive reactivity addition Y caused the stable source range count rate to increase from 320 cps to 640 cps.

Which one of the following statements describes how the magnitudes of the two positive reactivity additions (X and Y) compare?

A. Reactivity addition X was several times greater in magnitude than reactivity addition Y.

B. Reactivity addition X was several times smaller in magnitude than reactivity addition Y.

C. Reactivity additions X and Y were about equal in magnitude.

D. There is not enough information given to determine the relationship between the reactivity additions.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.3/3.4]
QID: B7698 (P7698)

A reactor is shutdown with a K_{eff} of 0.96. The source range count rate is stable at 480 cps. What percentage of the core neutron population is being contributed directly by neutron sources other than neutron-induced fission?

A. 4 percent

B. 50 percent

C. 96 percent

D. 100 percent

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: B7718 (P7718)

During a reactor startup, positive reactivity addition X caused the stable source range count rate to increase from 15 cps to 30 cps. Later in the startup, after several more positive reactivity additions, positive reactivity addition Y caused the stable source range count rate to increase from 60 cps to 120 cps.

With the reactor still subcritical, which one of the following statements describes how the magnitudes of positive reactivity additions X and Y compare?

A. Positive reactivity addition X was smaller than positive reactivity addition Y.

B. Positive reactivity addition X was greater than positive reactivity addition Y.

C. Positive reactivity additions X and Y were about equal in magnitude.

D. There is not enough information given to compare the positive reactivity additions.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B267

A reactor startup is in progress with K_{eff} at 0.999 and reactor period stable at infinity. If a control rod is withdrawn one notch, reactor period will initially become __________ and then __________. (Assume K_{eff} remains less than 1.0.)

A. positive; approach infinity

B. positive; stabilize at a positive value

C. negative; approach infinity

D. negative; stabilize at a negative value

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B966

During an initial reactor fuel load, the 1/M factor decreases from 1.0 to 0.5 after the first 100 fuel assemblies are loaded. What is the current value of K_{eff}?

A. 0.2

B. 0.5

C. 0.875

D. 1.0

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B1365 (P267)

As criticality is approached during a reactor startup, equal insertions of positive reactivity result in a __________ numerical change in the stable source range count rate and a __________ time to reach each new stable count rate.

A. larger; longer

B. larger; shorter

C. smaller; longer

D. smaller; shorter

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B1665 (P1770)

Refer to the drawing of three 1/M plots labeled A, B, and C (see figure below). Each axis has linear units.

The least conservative approach to criticality is represented by plot __________; which could possibly result from recording source range count rates at __________ time intervals after incremental fuel loading steps as compared to the conditions represented by the other plots.

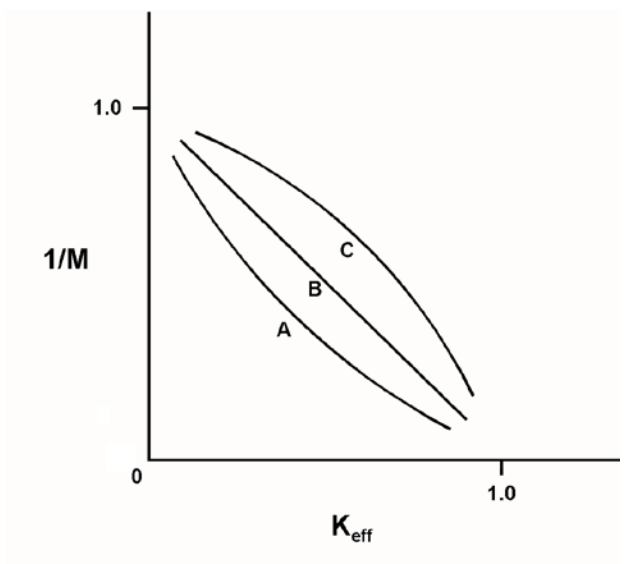
A. A; shorter

B. A; longer

C. C; shorter

D. C; longer

ANSWER: C.



TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B1967 (P1265)

During an initial fuel load, the subcritical multiplication factor increases from 1.0 to 4.0 as the first 100 fuel assemblies are loaded. What is K_{eff} after the first 100 fuel assemblies are loaded?

A. 0.25

B. 0.5

C. 0.75

D. 1.0

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B3566

A reactor startup is in progress for a reactor that is in the middle of a fuel cycle. The reactor is at normal operating temperature and pressure. The main steam isolation valves are open and the main turbine bypass (also called steam dump) valves are closed. The reactor is near criticality.

Reactor period is stable at infinity when, suddenly, a turbine bypass valve fails open and remains stuck open, dumping steam to the main condenser. The operator immediately ensures no control motion is occurring and takes no further action. Assume the reactor vessel water level remains stable, the reactor does not scram, and no other protective actions occur.

As a result of the valve failure, reactor period will initially become __________; and reactor power will stabilize __________ the point of adding heat.

A. positive; below

B. positive; above

C. negative; below

D. negative; above

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B3665 (P3665)

Refer to the drawing of a 1/M plot with curves A and B (see figure below). Each axis has linear units.

Curve A would result if each fuel assembly loaded during the early stages of the refueling caused a relatively __________ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal __________.

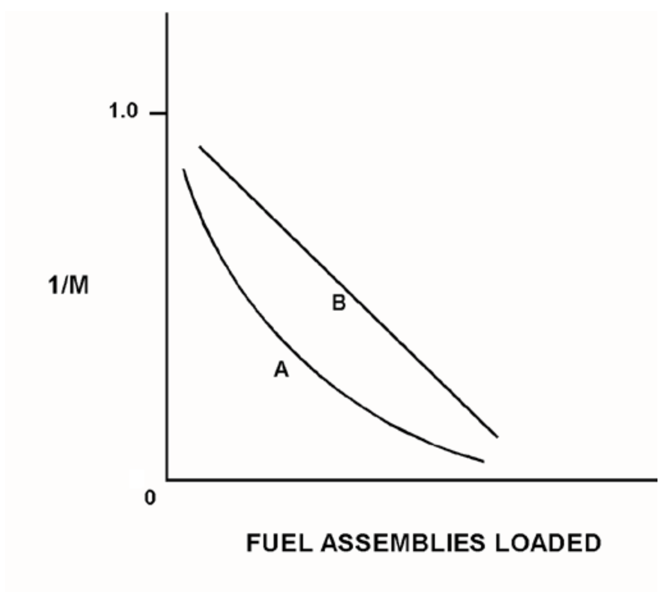
A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity

ANSWER: D.



TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B5733 (P5733)

During an initial fuel load, the subcritical multiplication factor increases from 1.0 to 8.0. What is the current value of K_{eff}?

A. 0.125

B. 0.5

C. 0.75

D. 0.875

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.05 [4.3/4.3]
QID: B6033 (P6034)

Refer to the drawing of a 1/M plot with curves A and B (see figure below). Each axis has linear units.

Curve A would result if each fuel assembly loaded during the early stages of core refueling caused a relatively __________ fractional change in stable source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal __________.

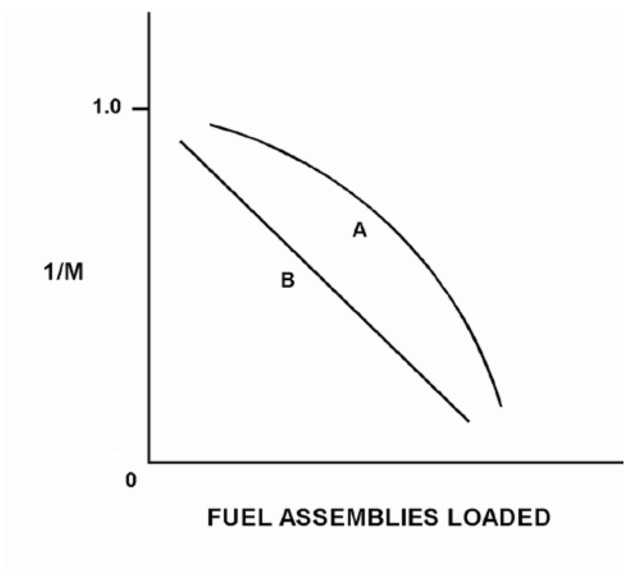
A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity

ANSWER: B.



TOPIC: 292008
KNOWLEDGE: K1.06 [4.2/4.2]
QID: B1567 (P1667)

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
0	180
5	200
10	225
15	257
20	300
25	360
30	450

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 40 units withdrawn

B. 50 units withdrawn

C. 60 units withdrawn

D. 70 units withdrawn

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.06 [4.2/4.2]
QID: B1767 (P1966)

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
10	360
15	400
20	450
25	514
30	600
35	720
40	900

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 50 units withdrawn

B. 60 units withdrawn

C. 70 units withdrawn

D. 80 units withdrawn

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.06 [4.2/4.2]
QID: B1866

A reactor has just achieved criticality during a xenon-free reactor startup. Instead of stabilizing source range count rate at 1.0×10^3 cps per the startup procedure, the operator inadvertently allows count rate to increase to 1.0×10^4 cps.

Assuming reactor vessel coolant temperature and pressure do <u>not</u> change, the critical rod height at 1.0×10^4 cps will be ___________ the critical rod height at 1.0×10^3 cps. (Neglect any effects of changes in fission product poisons.)

A. different, but unpredictable compared to

B. less than

C. greater than

D. equal to

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.06 [4.2/4.2]
QID: B2767 (P1167)

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
0	180
10	210
15	250
20	300
25	360
30	420

Assuming uniform differential rod worth, at what approximate control rod position 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

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.07 [3.9/3.9]
QID: B123 (P68)

With K_{eff} at 0.985, how much reactivity must be added to make a reactor exactly critical?

A. 1.48 %ΔK/K

B. 1.50 %ΔK/K

C. 1.52 %ΔK/K

D. 1.54 %ΔK/K

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.07 [3.9/3.9]
QID: B667

When a reactor is critical, reactivity is...

A. greater than 1.0 %ΔK/K.

B. equal to 1.0 %ΔK/K.

C less than 1.0 %ΔK/K.

D. undefined.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.07 [3.9/3.9]
QID: B867 (P2267)

When a reactor is critical, reactivity is...

A. infinity.

B. undefined.

C. 0.0 $\Delta K/K$.

D. 1.0 $\Delta K/K$.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B269

A reactor startup is in progress. A stable positive 30-second reactor period has been established, and no further reactivity changes occur. The reactor is...

A. critical.

B. supercritical.

C. subcritical.

D. prompt critical.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B868

Which one of the following indicates that a reactor has achieved criticality during a normal reactor startup?

A. Constant positive period with no control rod motion.

B. Increasing positive period with no control rod motion.

C. Constant positive period during control rod withdrawal.

D. Increasing positive period during control rod withdrawal.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B1069

A reactor is critical just below the point of adding heat (POAH) at a temperature of 160°F in the middle of a fuel cycle. Which one of the following will result in reactor power increasing and stabilizing at the POAH?

A. Reactor recirculation flow increases 10 percent.

B. Reactor coolant temperature increases 3°F.

C. A single control rod is inserted one notch.

D. Core xenon-135 concentration decreases.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B2668

A reactor is critical at 1.0×10^{-6} percent power. Control rods are withdrawn for 5 seconds and then stopped, resulting in a stable reactor period of positive 100 seconds.

If control rods had been inserted (instead of withdrawn) for 5 seconds with the reactor initially critical at 1.0×10^{-6} percent power, the stable reactor period would have been… (Assume equal absolute values of reactivity are added in both cases.)

A. longer than negative 100 seconds, because reactor power decreases are more limited by delayed neutrons than power increases.

B. shorter than negative 100 seconds, because reactor power decreases are less limited by delayed neutrons than power increases.

C. longer than negative 100 seconds, because reactor power decreases result in smaller delayed neutron fractions than power increases.

D. shorter than negative 100 seconds, because reactor power decreases result in larger delayed neutron fractions than power increases.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.08 [3.3/3.4]
QID: B2966

A reactor startup is in progress. Control rod withdrawal was stopped several minutes ago to assess criticality. Which one of the following is a combination of indications that together support a declaration that the reactor has reached criticality?

A. Period is stable at positive 200 seconds; source range count rate is stable.

B. Period is stable at infinity; source range count rate is stable.

C. Period is stable at positive 200 seconds; source range count rate is slowly increasing.

D. Period is stable at infinity; source range count rate is slowly increasing.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B5334 (P5334)

Given:

- Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.0068 and reactor B has an effective delayed neutron fraction of 0.0052.
- Reactor A has a stable period of 45 seconds and reactor B has a stable period of 42 seconds.
- Both reactors reach 1.0×10^{-8} percent power at the same instant.

The reactor that is supercritical by the greater amount of positive reactivity is reactor __________; and the first reactor to reach 1.0×10^{-1} percent power will be reactor __________.

A A; A

B. A; B

C. B; A

D. B; B

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B5534 (P5535)

A reactor is currently operating in the source range with a stable positive 90-second period. The core effective delayed neutron fraction ($\bar{\beta}_{eff}$) is 0.006. How much additional positive reactivity is needed to establish a stable positive 60-second period?

A. 0.026 %ΔK/K

B. 0.033 %ΔK/K

C. 0.067 %ΔK/K

D. 0.086 %ΔK/K

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B6434 (P6435)

A reactor is critical near the end of a fuel cycle with power level stable at 1.0×10^{-10} percent. Which one of the following is the smallest listed amount of positive reactivity that is capable of increasing reactor power level to the point of adding heat?

A. 0.001 %ΔK/K

B. 0.003 %ΔK/K

C. 0.005 %ΔK/K

D. 0.007 %ΔK/K

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B7688 (P7688)

Given:

- Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.0055 and reactor B has an effective delayed neutron fraction of 0.0052.
- Reactor A has a stable period of 42 seconds and reactor B has a stable period of 45 seconds.
- Both reactors pass through 1.0 x 10^{-8} percent power at the same instant.

The reactor that is supercritical by the greater amount of positive reactivity is reactor __________; and the first reactor to reach 1.0 x 10^{-1} percent power will be reactor __________.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
QID: B7757

Reactors A and B are identical except that reactor A is operating near the beginning of a fuel cycle, while reactor B is operating near the end of a fuel cycle. Both reactors have the same slightly positive value for K_{eff}.

If both reactors pass through 1.0 x 10^{-6} percent reactor power at the same time, which reactor, if any, will reach the point of adding heat (POAH) first, and why?

A. Reactor A, because it has the shorter reactor period.

B. Reactor B, because it has the shorter reactor period.

C. Both reactors will reach the POAH at the same time because they both have the same value for reactor period.

D. Both reactors will reach the POAH at the same time because they are both supercritical by the same amount of positive reactivity.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.08 [4.1/4.1]
KNOWLEDGE: K1.11 [3.7/3.8]
QID: B7778

A reactor and plant startup is in progress. Reactor power is currently 5.0 x 10^{-5} percent and increasing, with a constant period of 130 seconds. Reactivity is <u>not</u> changing.

The reactor is currently __________, at a power level that is __________ the point of adding heat.

A. critical; less than

B. critical; greater than

C. supercritical; less than

D. supercritical; greater than

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.10 [3.6/3.6]
QID: B468

A reactor is being started up from cold shutdown conditions and currently has a stable positive 100-second reactor period in the intermediate range. Assuming no operator action is taken that affects reactivity, which one of the following describes how reactor period will respond?

A. Remain constant until void production begins in the core.

B. Remain constant until saturation temperature is reached in the core.

C. Increase to infinity after heat production in the core exceeds ambient heat loss.

D. Decrease to zero as the fuel temperature increase adds negative reactivity to the core.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.10 [3.6/3.6]
QID: B2168 (P1870)

A reactor startup is in progress following a one-month shutdown. Upon reaching criticality, the operator establishes a positive 80-second period and stops control rod motion.

After an additional five minutes, reactor power will be __________; and reactor period will be __________. (Assume reactor power remains below the point of adding heat.)

A. constant; constant

B. constant; increasing

C. increasing; constant

D. increasing; increasing

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.10 [3.6/3.6]
QID: B2671

A reactor is being started up under cold shutdown conditions. The reactor has a stable positive 100-second period and power is entering the intermediate range. Assuming no operator action is taken that affects reactivity, reactor period will remain constant until...

A. void production begins in the core, then reactor period will increase toward infinity.

B. core heat production exceeds ambient losses, then reactor period will increase toward infinity.

C. xenon-135 production becomes significant, then reactor period will decrease toward zero.

D. fuel temperature begins to increase, then reactor period will decrease toward zero.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.11 [3.7/3.8]
QID: B568

After recording critical data during a cold reactor startup with main steam isolation valves open, the operator withdraws the control rods to continue the startup. Which one of the following pairs of parameters will provide the first indications of reaching the point of adding heat?

A. Reactor pressure and reactor water level

B. Reactor power and reactor period

C. Reactor pressure and turbine load

D. Reactor water level and core flow rate

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.11 [3.7/3.8]
QID: B3934 (P3935)

After taking critical data during a reactor startup, the operator establishes a stable 50-second reactor period to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize reactor power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.006.)

A. -0.01 %ΔK/K

B. -0.06 %ΔK/K

C. -0.10 %ΔK/K

D. -0.60 %ΔK/K

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B133

A reactor is critical well below the point of adding heat when a small amount of positive reactivity is added to the core. If the same amount of negative reactivity is added to the core approximately one minute later, reactor power will stabilize at...

A. the initial power level.

B. somewhat higher than the initial power level.

C. somewhat lower than the initial power level.

D. the subcritical multiplication equilibrium level.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B1467

Initially, a reactor is critical just below the point of adding heat when a small amount of negative reactivity is added to the reactor. If an equal amount of positive reactivity is added to the reactor 5 minutes later, reactor power will...

A. increase, and then stabilize at the initial power level.

B. increase, and then stabilize at the point of adding heat.

C. stabilize at a critical power level below the initial power level.

D. continue to decrease on a negative 80-second period until it stabilizes at a power level determined by the source neutron flux.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B2268

A reactor startup is in progress and criticality has just been achieved. After recording critical rod heights, the operator withdraws control rods for 20 seconds to establish a stable positive 30-second reactor period. One minute later (well before to the point of adding heat) the operator inserts the same control rods for 25 seconds. (Assume the control rod withdrawal and insertion rates are the same.)

During the rod insertion, the reactor period will become...

A. negative during the entire period of control rod insertion.

B. negative shortly after the control rods pass through the critical rod height.

C. negative just as the control rods pass through the critical rod height.

D. negative shortly before the control rods pass through the critical rod height.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B2467

Criticality has just been achieved during a reactor startup at 160°F. The main steam isolation valves are closed (*i.e.*, no steam flow from reactor). The operator withdraws control rods as necessary to establish a stable positive 60-second reactor period. No additional operator actions are taken.

How will reactor power and reactor period respond after the control rod withdrawal is completed? (Assume a negative moderator temperature coefficient.)

A. Reactor power will increase and stabilize at the POAH; reactor period will remain nearly constant until the POAH is reached and then stabilize at infinity.

B. Reactor power will increase and stabilize at the POAH; reactor period will decrease slowly until the POAH is reached and then stabilize at infinity.

C. Reactor power will increase and stabilize above the POAH; reactor period will remain nearly constant until the POAH is reached and then stabilize at infinity.

D. Reactor power will increase and stabilize above the POAH; reactor period will decrease slowly until the POAH is reached and then stabilize at infinity.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B2568 (P2568)

A reactor was operating at 1.0 x 10^{-3} percent power with a positive 60-second reactor period when an amount of negative reactivity was inserted that caused reactor power to decrease with a negative 40-second reactor period.

If an equal amount of positive reactivity is added 5 minutes later, reactor power will...

A. increase and stabilize at the point of adding heat.

B. increase and stabilize at 1.0 x 10^{-3} percent power.

C. continue to decrease with a negative 40-second period until an equilibrium shutdown neutron level is reached.

D. continue to decrease with an unknown period until an equilibrium shutdown neutron level is reached.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B2969

A reactor startup is in progress and criticality has just been achieved. After recording the critical rod heights, the operator withdraws a control rod for 20 seconds to establish a stable positive 60-second reactor period. One minute later (well before reaching the point of adding heat), the operator inserts the same control rod for 25 seconds. (Assume the control rod withdrawal and insertion rates are the same.)

During the control rod insertion, when will the reactor period become negative?

A. Immediately when the control rod insertion is initiated.

B. After the control rod passes through the critical rod height.

C. Just as the control rod passes through the critical rod height.

D. Prior to the control rod passing through the critical rod height.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B3668

Initially, a reactor is critical in the source range when a short control rod withdrawal is performed to establish the desired reactor period. Assume that reactor power remains well below the point of adding heat.

Immediately after the control rod withdrawal is stopped, the reactor period will initially lengthen and then...

A. stabilize at a positive value.

B. turn and slowly shorten.

C. stabilize at infinity.

D. continue to slowly lengthen.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B4034

Initially, a reactor is critical in the source range when a constant rate of positive reactivity addition commences and lasts for 120 seconds. Assume that reactor power remains below the point of adding heat for the entire 120-second addition of positive reactivity.

During the 120-second addition of positive reactivity, the reactor period will initially shorten and then continue to shorten at a/an __________ rate; and reactor power will initially increase and then continue to increase at a/an __________ rate.

A. decreasing; increasing

B. decreasing; decreasing

C. increasing; increasing

D. increasing; decreasing

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B271

Upon reaching criticality during a reactor startup, the operator establishes a positive reactor period. Upon reaching the point of adding heat, the period will become __________ due to the __________ reactivity feedback from the moderator and fuel temperatures.

A. shorter; negative

B. shorter; positive

C. longer; negative

D. longer; positive

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B5833 (P5834)

Refer to the drawing that shows a graph of fission rate versus time (see figure below). Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, would cause the reactor response shown on the graph?

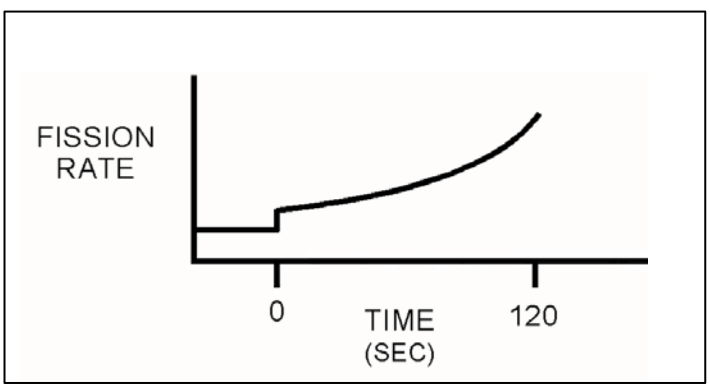
A. A step addition of positive reactivity to a reactor that is initially subcritical in the source range and remains subcritical for the duration of the 120-second interval shown.

B. A step addition of positive reactivity to a reactor that is initially critical in the source range and remains below the point of adding heat for the duration of the 120-second interval shown.

C. A step addition of positive reactivity to a reactor that is initially critical in the power range and remains in the power range for the duration of the 120-second interval shown.

D. A constant rate of positive reactivity addition to a reactor that is initially critical in the power range and remains in the power range for the duration of the 120-second interval shown.

ANSWER: B.



TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B6734 (P6734)

Reactors A and B are identical, except that reactor A has an effective delayed neutron fraction of 0.007, while reactor B has an effective delayed neutron fraction of 0.006. Initially, both reactors are critical at 1.0 x 10^{-8} percent power when +0.1 %ΔK/K is instantly added to both reactors.

Five minutes after the reactivity additions, reactor _____ will be at the higher power level; and reactor _____ will have the shorter period.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.12 [3.6/3.7]
QID: B7768 (P7768)

Initially, a reactor was critical just below the point of adding heat during a normal reactor startup when a reactivity event caused a rapid insertion of negative reactivity. No subsequent changes to reactivity occurred.

Ten seconds after the completion of the negative reactivity insertion, the reactor period was observed to be stable at – 110 seconds. Was the reactivity event a reactor scram or the uncontrolled rapid insertion of a fully-withdrawn control rod, and why?

A. Reactor scram, because the uncontrolled rapid insertion of a fully-withdrawn control rod will <u>not</u> produce a stable negative reactor period 10 seconds after the completion of the negative reactivity insertion.

B. Reactor scram, because the uncontrolled rapid insertion of a fully-withdrawn control rod will produce a <u>more</u> negative stable reactor period 10 seconds after the completion of the negative reactivity insertion.

C. The uncontrolled rapid insertion of a fully-withdrawn control rod, because a reactor scram will <u>not</u> produce a stable negative reactor period 10 seconds after the completion of the negative reactivity insertion.

D. The uncontrolled rapid insertion of a fully-withdrawn control rod, because a reactor scram will produce a <u>less</u> negative stable reactor period 10 seconds after the completion of the negative reactivity insertion.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B670 (P670)

After taking critical data during a reactor startup, the operator establishes a positive 26-second reactor period to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize reactor power at the POAH? (Assume that $\bar{\beta}_{eff}$ = 0.00579.)

A. -0.16 %ΔK/K

B. -0.19 %ΔK/K

C. -0.23 %ΔK/K

D. -0.29 %ΔK/K

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B968

After taking critical data during a reactor startup, the operator establishes a positive 26-second reactor period to increase power to the point of adding heat (POAH). How much negative reactivity must be added to stabilize power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.00579.)

A. 0.10 %ΔK/K

B. 0.16 %ΔK/K

C. 1.0 %ΔK/K

D. 1.6 %ΔK/K

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B1667

After taking critical data during a reactor startup, the operator establishes a 38-second reactor period to increase power to the point of adding heat (POAH). Which one of the following is the approximate negative reactivity required to stop the power increase at the POAH? (Assume that $\bar{\beta}_{eff}$ = 0.00579.)

A. 0.01 %ΔK/K

B. 0.12 %ΔK/K

C. 0.16 %ΔK/K

D. 0.21 %ΔK/K

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B1769

After taking critical data during a reactor startup, the operator establishes a positive 31-second reactor period to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.00579.)

A. -0.14 %ΔK/K

B. -0.16 %ΔK/K

C. -1.4 %ΔK/K

D. -1.6 %ΔK/K

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B2369 (P2370)

After taking critical data during a reactor startup, the operator establishes a positive 48-second reactor period to increase reactor power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.00579.)

A. +0.10 %ΔK/K

B. +0.12 %ΔK/K

C. -0.10 %ΔK/K

D. -0.12 %ΔK/K

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.13 [3.8/3.9]
QID: B3068 (P3068)

After taking critical data during a reactor startup, the operator establishes a positive 34-second reactor period to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize reactor power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.0066.)

A. -0.10 %ΔK/K

B. -0.12 %ΔK/K

C. -0.15 %ΔK/K

D. -0.28 %ΔK/K

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.14 [3.5/3.5]
QID: B769

During a reactor heatup, if a center control rod is notched outward with no subsequent operator action, the heatup rate will...

A. increase initially, then gradually decrease.

B. decrease initially, then gradually increase.

C. increase and stabilize at a new higher value.

D. decrease and stabilize at a new lower value.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.14 [3.5/3.5]
QID: B1071

A reactor heatup from 180°F to 500°F is in progress. To maintain a constant heatup rate as reactor temperature increases, reactor power will have to...

A. increase, due to increasing density of water.

B. decrease, due to decreasing specific heat of water.

C. increase, due to increasing heat losses to ambient.

D. decrease, due to decreasing heat of vaporization of water.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.14 [3.5/3.5]
QID: B1468

A nuclear power plant is undergoing a startup with the reactor coolant initially saturated at 508°F. The main steam isolation valves are closed and reactor criticality has been achieved. The reactor currently has a stable positive 100-second reactor period with reactor power well below the point of adding heat (POAH).

Which one of the following will occur first when reactor power reaches the POAH?

A. Reactor period will shorten.

B. Reactor pressure will increase.

C. Reactor coolant temperature will decrease.

D. Intermediate range power level will decrease.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.15 [3.7/3.7]
QID: B6335

A nuclear power plant is undergoing a startup with the reactor water initially saturated at 508°F. The main steam isolation valves are closed. Currently, the reactor has a stable positive 100-second reactor period and reactor power is well below the point of adding heat (POAH).

Which one of the following will occur first when reactor power reaches the POAH?

A. Reactor power will decrease.

B. Reactor period will lengthen.

C. Reactor pressure will increase.

D. Reactor water temperature will increase.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.15 [3.7/3.7]
QID: B469

A reactor is stable at the point of adding heat (POAH) with a reactor coolant temperature of 160°F. Control rods are about to be withdrawn a few notches to establish a small heatup rate.

When the control rods are withdrawn, reactor power will increase initially, and then...

A. stabilize until voiding begins to occur.

B. continue to increase until voiding begins to occur.

C. decrease and stabilize at a subcritical power level.

D. decrease and stabilize at the POAH.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.15 [3.7/3.7]
QID: B669

A reactor has a stable positive 100-second period, with reactor power entering the intermediate range. Assuming no operator action, which one of the following describes the future response of reactor period? (Ignore any changes in fission product poison reactivity.)

A. Prior to reaching the point of adding heat, the fuel temperature increase will add negative reactivity and reactor period will approach infinity.

B. When heat production in the reactor exceeds ambient heat losses, the temperature of the fuel and moderator will increase, adding negative reactivity, and reactor period will approach infinity.

C. The heat produced by the reactor when operating in the intermediate range is insufficient to raise the fuel or moderator temperatures, and reactor period will remain nearly constant throughout the entire intermediate range.

D. When heat production in the reactor exceeds ambient losses, positive reactivity from a fuel temperature increase will offset the negative reactivity from a moderator temperature increase, and reactor period will remain nearly constant throughout the entire intermediate range.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.15 [3.7/3.7]
QID: B1966

A reactor startup is in progress at the beginning of core life. Reactor power is 5.0 x 10^{-3} percent and increasing slowly with a stable period of 87 seconds. Assuming no operator action, no reactor scram, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH).

B. At the POAH.

C. Above the POAH but less than 49 percent.

D. 50 percent.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.15 [3.7/3.7]
QID: B2569

A reactor is at 1.0 x 10^{-3} percent power with a stable period of positive 60 seconds at the beginning of a fuel cycle. Assuming no operator action, no reactor scram, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH).

B. At the POAH.

C. Approximately 22 percent.

D. Greater than 100 percent.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.15 [3.7/3.7]
QID: B7808 (P7808)

Given the following:

- Initially, reactor power is 1.0 x 10^{-3} percent and increasing with a constant period of 260 seconds.
- The turbine bypass system is maintaining reactor pressure at 1,000 psia.
- The point of adding heat is 1.0 percent power.
- The power coefficient is −1.0 x 10^{-4} ΔK/K/percent power.
- The effective delayed neutron fraction is 0.006.
- No operator actions or automatic protective actions occur.

In 40 minutes, reactor power will be approximately...

A. 3 percent and stable.

B. 3 percent and increasing.

C. 10 percent and stable.

D. 10 percent and increasing.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.16 [3.6/3.7]
QID: B870

During a reactor heatup, reactor pressure was increased from 5 psig to 50 psig in a 2-hour period. What was the average heatup rate?

A. 35°F/hr

B. 60°F/hr

C. 70°F/hr

D. 120°F/hr

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.16 [3.6/3.7]
QID: B1972

A reactor is critical and a reactor coolant heatup is in progress with coolant temperature currently at 140°F. If the point of adding heat is initially 0.1 percent reactor power, and reactor power is held constant at 1.0 percent during the heatup, which one of the following describes the coolant heatup rate (HUR) from 140°F to 200°F?

A. HUR will initially decrease and then increase.

B. HUR will slowly decrease during the entire period.

C. HUR will slowly increase during the entire period.

D. HUR will remain the same during the entire period.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B1270

Which one of the following will add the most positive reactivity during a power decrease from 100 percent to 65 percent over a one-hour period? (Assume the power change is performed only by changing core recirculation flow rate.)

A. Fuel temperature change

B. Moderator temperature change

C. Fission product poison change

D. Core void fraction change

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B1371 (P1470)

With a reactor on a constant period, which one of the following power changes requires the longest time to occur?

A. 1.0×10^{-8} percent to 4.0×10^{-8} percent

B. 5.0×10^{-8} percent to 1.5×10^{-7} percent

C. 2.0×10^{-7} percent to 3.5×10^{-7} percent

D. 4.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B1570 (P1567)

With a reactor on a constant period, which one of the following power changes requires the least amount of time to occur?

A. 1.0×10^{-8} percent to 6.0×10^{-8} percent

B. 1.0×10^{-7} percent to 2.0×10^{-7} percent

C. 2.0×10^{-7} percent to 3.5×10^{-7} percent

D. 4.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B1671 (P1672)

A refueling outage has just been completed, during which one-third of the core was replaced with new fuel assemblies. A reactor startup has been performed to begin the sixth fuel cycle, and reactor power is being increased to 100 percent.

Which one of the following pairs of reactor fuels will provide the greatest contribution to core heat production when the reactor reaches 100 percent power?

A. U-235 and U-238

B. U-238 and Pu-239

C. U-235 and Pu-239

D. U-235 and Pu-241

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B1765

Which one of the following lists the method(s) used to add positive reactivity during a normal power increase from 10 percent to 100 percent?

A. Control rod withdrawal only.

B. Recirculation pump flow increase only.

C. Control rod withdrawal and recirculation pump flow increase.

D. Recirculation pump flow increase and steaming rate increase.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2070 (P2071)

Ignoring the effects of changes in fission product poisons, which one of the following power changes requires the greatest amount of positive reactivity addition?

A. 3 percent to 5 percent

B. 5 percent to 15 percent

C. 15 percent to 30 percent

D. 30 percent to 60 percent

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2072 (P2069)

With a reactor on a constant period, which one of the following power changes requires the longest amount of time to occur?

A. 3.0 x 10^{-8} percent to 5.0 x 10^{-8} percent

B. 5.0 x 10^{-8} percent to 1.5 x 10^{-7} percent

C. 1.5 x 10^{-7} percent to 3.0 x 10^{-7} percent

D. 3.0 x 10^{-7} percent to 6.0 x 10^{-7} percent

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2166

A reactor is operating at 80 percent power near the end of a fuel cycle. Which one of the following lists the typical method(s) used to increase power to 100 percent?

A. Withdrawal of deep control rods and increasing recirculation flow rate.

B. Withdrawal of deep control rods only.

C. Withdrawal of shallow control rods and increasing recirculation flow rate.

D. Withdrawal of shallow control rods only.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2270

With a reactor on a constant period, which one of the following power changes requires the shortest time to occur?

A. 1.0×10^{-8} percent to 4.0×10^{-8} percent

B. 5.0×10^{-8} percent to 1.5×10^{-7} percent

C. 2.0×10^{-7} percent to 3.5×10^{-7} percent

D. 4.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2470 (P2851)

Ignoring the effects of changes in fission product poisons, which one of the following power changes requires the greatest amount of positive reactivity addition?

A. 3 percent to 10 percent

B. 10 percent to 25 percent

C. 25 percent to 60 percent

D. 60 percent to 100 percent

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2669 (P2169)

Ignoring the effects of changes in fission product poisons, which one of the following power changes requires the smallest amount of positive reactivity addition?

A. 2 percent to 5 percent

B. 5 percent to 15 percent

C. 15 percent to 30 percent

D. 30 percent to 50 percent

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B2770 (P2770)

With a reactor on a constant period, which one of the following power changes requires the least amount of time to occur?

A. 3.0×10^{-8} percent to 5.0×10^{-8} percent

B. 5.0×10^{-8} percent to 1.5×10^{-7} percent

C. 1.5×10^{-7} percent to 3.0×10^{-7} percent

D. 3.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B3769 (P3753)

Ignoring the effects of changes in fission product poisons, which one of the following power changes requires the smallest amount of positive reactivity addition?

A. 3 percent to 10 percent

B. 10 percent to 15 percent

C. 15 percent to 30 percent

D. 30 percent to 40 percent

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.18 [3.8/3.8]
QID: B5034 (P2953)

Ignoring the effects of changes in fission product poisons, which one of the following reactor power changes requires the greatest amount of positive reactivity addition?

A. 3 percent to 10 percent

B. 10 percent to 25 percent

C. 25 percent to 65 percent

D. 65 percent to 100 percent

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B69

With a nuclear power plant operating at steady-state 45 percent power, for which one of the following events will the Doppler coefficient act first to change the reactivity of the core?

A. A control rod drop.

B. The loss of one feedwater heater (extraction steam isolated).

C. Tripping of the main turbine.

D. A safety relief valve opening.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B367

Reactor power was increased from 20 percent to 30 percent in one hour using only control rod withdrawal. Which one of the following describes the response of void fraction during the power increase?

A. Void fraction initially decreases, then increases back to the original value.

B. Void fraction initially increases, then decreases back to the original value.

C. Void fraction decreases and stabilizes below the original value.

D. Void fraction increases and stabilizes above the original value.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B1169

Which one of the following describes the core void fraction response that accompanies a reactor power increase from 20 percent to 30 percent using only control rod withdrawal?

A. Decreases and stabilizes at a lower void fraction.

B. Increases and stabilizes at a higher void fraction.

C. Initially decreases, then increases and stabilizes at the initial void fraction.

D. Initially increases, then decreases and stabilizes at the initial void fraction.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B1368

A reactor is operating at 90 percent power near the end of a fuel cycle. When an operator withdraws a shallow control rod two notches, a power decrease occurs. This power decrease can be attributed to a relatively __________ differential rod worth and a relatively __________ increase in bundle void content.

A. large; small

B. large; large

C. small; small

D. small; large

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B2354

Initially, a reactor is operating at steady-state 20 percent power when power is increased to 40 percent. In comparison to the operating conditions at 20 percent power, when the plant stabilizes at 40 percent power, reactor vessel pressure will be __________, and reactor vessel water temperature will be __________.

A. the same; the same

B. the same; higher

C. higher; the same

D. higher; higher

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B2670

A reactor was operating with the following initial conditions:

Power level = 100 percent
Control rod density = 60 percent

After a power decrease, current reactor conditions are as follows:

Power level = 80 percent
Control rod density = 62 percent

All parameters attained steady-state values before and after the power change.

Given the following:

Total control rod reactivity change = -2.2×10^{-1} %ΔK/K
Power coefficient = -1.5×10^{-2} %ΔK/K/% power

How much reactivity was added by changes in core recirculation flow rate during the load decrease? (Assume fission product poison reactivity does <u>not</u> change.)

A. 0.0 %ΔK/K

B. -5.2×10^{-1} %ΔK/K

C. -2.0×10^{-1} %ΔK/K

D. -8.0×10^{-2} %ΔK/K

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B2970

Which one of the following increases in void fraction would produce the greatest amount of negative reactivity?

A. From 5 percent to 10 percent near the beginning of a fuel cycle.

B. From 5 percent to 10 percent near the end of a fuel cycle.

C. From 40 percent to 45 percent near the beginning of a fuel cycle.

D. From 40 percent to 45 percent near the end of a fuel cycle.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B3051 (P3050)

A reactor startup is in progress with the reactor at normal operating temperature and pressure. With reactor power stable at the point of adding heat, a control rod malfunction causes an inadvertent rod withdrawal that results in adding 0.3 %ΔK/K reactivity.

Given:

- All control rod motion has been stopped.
- No automatic system or operator actions occur to inhibit the power increase.
- Power coefficient equals -0.04 %ΔK/K/percent.
- The effective delayed neutron fraction equals 0.006.

What is the reactor power level increase required to offset the reactivity added by the inadvertent control rod withdrawal? (Ignore any reactivity effects from changes in fission product poisons.)

A. 3.0 percent

B. 5.0 percent

C. 6.7 percent

D. 7.5 percent

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B4325 (P4327)

A reactor startup is in progress with the reactor at normal operating temperature and pressure. With reactor power stable at the point of adding heat, a control rod malfunction causes an inadvertent rod withdrawal that results in adding 0.2 %ΔK/K reactivity.

Given:

- All control rod motion has been stopped.
- No automatic system or operator actions occur to inhibit the power increase.
- Power coefficient equals -0.04 %ΔK/K/percent.
- The effective delayed neutron fraction equals 0.006.

What is the reactor power level increase required to offset the reactivity added by the inadvertent control rod withdrawal? (Ignore any reactivity effects from changes in fission product poisons.)

A. 3.3 percent

B. 5.0 percent

C. 6.7 percent

D. 7.5 percent

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.19 [3.1/3.2]
QID: B6736 (P6727)

A reactor startup is in progress with the reactor at normal operating temperature and pressure. With reactor power stable at the point of adding heat, a control rod malfunction causes a short rod withdrawal that increases reactivity by 0.14 %ΔK/K.

Given:

- All control rod motion has stopped.
- No automatic system or operator actions occur to inhibit the power increase.
- Power coefficient equals -0.028 %ΔK/K/percent.
- The effective delayed neutron fraction equals 0.006.

What is the reactor power level increase required to offset the reactivity added by the control rod withdrawal? (Ignore any reactivity effects from changes in fission product poisons.)

A. 2.0 percent

B. 5.0 percent

C. 20 percent

D. 50 percent

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.20 [3.3/3.4]
QID: B70

Initially, a nuclear power plant is operating at steady-state 100 percent power and 100 percent core flow rate. Then, reactor power is reduced to 90 percent by inserting control rods. (Assume that recirculation pump speed and valve positions do not change.)

What is the effect of the power reduction on core flow rate?

A. Core flow rate will increase, due to a decrease in recirculation ratio.

B. Core flow rate will increase, due to a decrease in two-phase flow resistance.

C. Core flow rate will decrease, due to an increase in recirculation ratio.

D. Core flow rate will decrease, due to an increase in two-phase flow resistance.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.20 [3.3/3.4]
QID: B1469

Which one of the following parameter changes will occur if reactor power is increased from 70 percent to 90 percent by changing recirculation flow?

A. Core void fraction will increase.

B. Feedwater temperature will decrease.

C. Reactor vessel outlet steam pressure will increase.

D. Condensate depression in the main condenser hotwell will increase.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.21 [2.9/3.0]
QID: B270

A nuclear power plant has been operating at steady-state 100 percent power for several months. Following a normal reactor shutdown, the rate of core decay heat production will depend on the...

A. rate of reactor power decrease from 100 percent to the point of adding heat.

B. pressure being maintained in the reactor pressure vessel (RPV).

C. pre-shutdown power level and the time elapsed since shutdown.

D. recirculation flow rate and the water level being maintained in the RPV.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.21 [2.9/3.0]
QID: B1372 (P1272)

Following a reactor shutdown from three months of operation at 100 percent power, the core decay heat production rate will depend on the...

A. amount of fuel that has been depleted.

B. decay rate of the fission product poisons.

C. time elapsed since K_{eff} decreased below 1.0.

D. decay rate of the photoneutron source.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.21 [2.9/3.0]
QID: B3169

Initially, a nuclear power plant is operating at steady-state 60 percent power in the middle of a fuel cycle when a turbine control system malfunction closes the turbine steam inlet valves an additional 5 percent. Which one of the following describes the initial reactor power change and the cause for the power change?

A. Decrease, because the rate of neutron absorption in the moderator initially increases.

B. Decrease, because the rate of neutron absorption at U-238 resonance energies initially increases.

C. Increase, because the rate of neutron absorption in the moderator initially decreases.

D. Increase, because the rate of neutron absorption at U-238 resonance energies initially decreases.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.21 [2.9/3.0]
QID: B4036

A nuclear power plant is operating at 60 percent power in the middle of a fuel cycle when a turbine control system malfunction opens the turbine steam inlet valves an additional 5 percent. Which one of the following describes the initial reactor power change and the cause for the power change?

A. Decrease, because the rate of neutron absorption in the moderator initially increases.

B. Decrease, because the rate of neutron absorption at U-238 resonance energies initially increases.

C. Increase, because the rate of neutron absorption in the moderator initially decreases.

D. Increase, because the rate of neutron absorption at U-238 resonance energies initially decreases.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.21 [2.9/3.0]
QID: B4735

Initially, a nuclear power plant is operating at steady-state 60 percent power when a main steam line break occurs. The break releases 5 percent of rated main steam mass flow rate.

Given the following:

- No operator or automatic protective actions occur.
- Automatic pressure control returns reactor pressure to its initial value.
- Feedwater injection temperature returns to its initial value.
- The break continues to release 5 percent of rated main steam mass flow rate.

Compared to the initial operating conditions, current reactor power is approximately __________; and current turbine power is approximately __________.

A. the same; 5 percent lower

B. the same; the same

C. 5 percent higher; 5 percent lower

D. 5 percent higher; the same

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.21 [2.9/3.0]
QID: B7798

Initially, a nuclear power plant is operating at steady-state 85 percent power when a failure of the turbine control system partially closes the turbine control valves, which reduces the main steam mass flow rate to the main turbine by 10 percent.

Given:

- No operator actions are taken.
- No protective system actuations occur.
- The turbine control valves remain in their failed positions.
- The turbine bypass valves remain closed.

In response to the turbine control system failure, reactor power will initially…

A. decrease, and then stabilize at a critical power level above the point of adding heat.

B. decrease, and then stabilize at a critical power level below the point of adding heat.

C. increase, and then decrease and stabilize at a critical power level above the point of adding heat.

D. increase, and then decrease and stabilize at a critical power level below the point of adding heat.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.22 [3.5/3.6]
QID: B570

Initially, a nuclear power plant is operating at steady-state 50 percent power when a steam line break occurs that releases a constant 5 percent of rated steam flow.

- No operator or protective actions occur.
- Automatic pressure control returns reactor pressure to its initial value.
- Feedwater injection temperature remains the same.

In response to the steam line break, reactor power will…

A. decrease and stabilize at a lower power level.

B. increase and stabilize at a higher power level.

C. decrease at first, then increase and stabilize near the initial power level.

D. increase at first, then decrease and stabilize near the initial power level.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.22 [3.5/3.6]
QID: B971

A nuclear power plant is operating at steady-state 85 percent power when a failure of the turbine control system positions the turbine control valves to admit 10 percent more steam flow to the main turbine. No operator actions are taken and <u>no</u> protective system actuations occur. The turbine control valves remain in the failed position.

In response to the above, reactor power will…

A. increase until power level matches the new steam demand.

B. increase continuously and exceed reactor protection set points.

C. decrease and stabilize at a lower power level above the point of adding heat.

D. decrease and stabilize at a critical power level below the point of adding heat.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.22 [3.5/3.6]
QID: B1670

A nuclear power plant is operating normally at 50 percent of rated power when a main steam line break occurs that continuously releases 5 percent of rated steam flow. Assume no operator or protective actions occur, automatic pressure control returns reactor pressure to its initial value, and feedwater injection temperature remains the same.

How will turbine power respond to the main steam line break?

A. Decrease and stabilize at a lower power level.

B. Increase and stabilize at a higher power level.

C. Initially decrease, then increase and stabilize at the previous power level.

D. Initially increase, then decrease and stabilize at the previous power level.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.22 [3.5/3.6]
QID: B2371

A nuclear power plant is operating at steady-state 90 percent power. If a turbine control system malfunction opens the turbine steam inlet valves an additional 5 percent, reactor power will initially...

A. increase, due to positive reactivity addition from the void coefficient only.

B. increase, due to positive reactivity addition from the void and moderator temperature coefficients.

C. decrease, due to negative reactivity addition from the void coefficient only.

D. decrease, due to negative reactivity addition from the void and moderator temperature coefficients.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.22 [3.5/3.6]
QID: B2571

A nuclear power plant is operating at steady-state 50 percent power. If a steam break occurs that releases 5 percent of rated steam flow, reactor power will initially...

A. increase, due to positive reactivity addition from the void coefficient only.

B. increase, due to positive reactivity addition from the void and moderator temperature coefficients.

C. decrease, due to negative reactivity addition from the void coefficient only.

D. decrease, due to negative reactivity addition from the void and moderator temperature coefficients.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.22 [3.5/3.6]
QID: B7748

A reactor is operating at steady-state 60 percent power in the middle of a fuel cycle when, suddenly, one main turbine bypass valve fails open and remains open. The operator immediately verifies that no control rod motion is occurring and takes no further action.

In addition,

- The reactor vessel water level remains stable.
- The automatic pressure control system returns reactor pressure to its initial value.
- The reactor does not scram and no other protective actions occur.

In response to the main turbine bypass valve failure, reactor power will…

A. decrease, and then stabilize at a lower power level.

B. increase, and then stabilize at a higher power level.

C. decrease, and then increase and stabilize near the initial power level.

D. increase, and then decrease and stabilize near the initial power level.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.23 [2.6/3.1]
QID: B368

Which one of the following is the purpose of a rod sequence exchange?

A. Ensures proper rod coupling.

B. Prevents rod shadowing.

C. Promotes even fuel burnout.

D. Minimizes water hole peaking.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.23 [2.6/3.1]
QID: B2572

During continuous reactor power operation, rod sequence exchanges are performed periodically to...

A. ensure some control rods remain inserted as deep control rods until late in the fuel cycle.

B. allow the local power range monitoring nuclear instruments to be asymmetrically installed in the core.

C. increase the rod worth of control rods that are nearly fully withdrawn.

D. prevent the development of individual control rods with very high reactivity worths.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B72 (P71)

Shortly after a reactor scram, reactor power indicates 5.0 x 10^{-2} percent when a stable negative reactor period is attained. Approximately how much additional time is required for reactor power to decrease to 5.0 x 10^{-3} percent?

A. 90 seconds

B. 180 seconds

C. 270 seconds

D. 360 seconds

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B771 (P770)

Which one of the following determines the value of the stable negative reactor period observed shortly after a reactor scram?

A. The shortest-lived delayed neutron precursors.

B. The longest-lived delayed neutron precursors.

C. The shutdown margin just prior to the scram.

D. The worth of the inserted control rods.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B1369 (P1965)

Shortly after a reactor scram, reactor power indicates 1.0×10^{-3} percent when a stable negative period is attained. Reactor power will decrease to 1.0×10^{-4} percent in approximately _______ seconds.

A. 380

B. 280

C. 180

D. 80

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B1770 (P2171)

Following a reactor scram, reactor power indicates 0.1 percent when the typical stable post-scram reactor period is observed. Approximately how much additional time is required for reactor power to decrease to 0.05 percent?

A. 24 seconds

B. 55 seconds

C. 173 seconds

D. 240 seconds

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B2071

A nuclear power plant is operating at 100 percent power near the end of core life when a single main steam isolation valve suddenly closes. Prior to a reactor scram, reactor power will initially...

A. increase, due to positive reactivity addition from the void coefficient only.

B. increase, due to positive reactivity addition from the void and moderator coefficients.

C. decrease, due to negative reactivity addition from the Doppler coefficient only.

D. decrease, due to negative reactivity addition from the Doppler and moderator temperature coefficients.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B2769 (P2768)

Reactors A and B are identical and have operated at 100 percent power for six months when a reactor scram occurs simultaneously on both reactors. All control rods fully insert, except for one reactor B control rod that remains fully withdrawn.

Which reactor, if any, will have the longer reactor period five minutes after the scram, and why?

A. Reactor A, due to the greater shutdown reactivity.

B. Reactor B, due to the smaller shutdown reactivity.

C. Both reactors will have the same reactor period because both reactors will be stable at a power level low in the source range.

D. Both reactors will have the same reactor period because only the longest-lived delayed neutron precursors will be releasing fission neutrons.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B3271 (P3271)

Reactors A and B are identical and have operated at 100 percent power for six months when a reactor scram occurs simultaneously on both reactors. All reactor A control rods fully insert. One reactor B control rod sticks fully withdrawn, but all others fully insert.

Five minutes after the scram, when compared to reactor B the fission rate in reactor A will be __________; and the reactor period in reactor A will be __________.

A. the same; shorter

B. the same; the same

C. smaller; shorter

D. smaller; the same

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B3472

A reactor is critical just below the point of adding heat when an inadvertent reactor scram occurs. All control rods fully insert except for one rod, which remains fully withdrawn. Five minutes after the reactor scram, with reactor period stable at approximately -80 seconds, the remaining withdrawn control rod suddenly and rapidly fully inserts.

Which one of the following describes the reactor response to the insertion of the last control rod?

A. The negative period will remain stable at approximately -80 seconds.

B. The negative period will immediately become shorter, and then stabilize at a value significantly shorter than -80 seconds.

C. The negative period will immediately become shorter, and then lengthen and stabilize at approximately -80 seconds.

D. The negative period will immediately become longer, and then shorten and stabilize at approximately -80 seconds.

ANSWER: C.

OPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B3771

A nuclear power plant has been operating at 100 percent power for two months when a reactor scram occurs. Five minutes after the scram, with all control rods still fully inserted, a count rate of 5,000 cps is indicated on the source range nuclear instruments with a reactor period of negative 80 seconds.

Currently, the majority of the source range detector output is being caused by detector interactions with…

A. intrinsic source neutrons.

B. fission gammas from previous power operation.

C. fission neutrons from subcritical multiplication.

D. delayed fission neutrons from previous power operation.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B4736

Reactors A and B are identical and have operated at 100 percent power for six months when a reactor scram occurs simultaneously on both reactors. All reactor A control rods fully insert. One reactor B control rod remains fully withdrawn, but all others fully insert.

When compared to reactor A at 10 minutes after the scram, the fission rate in reactor B will be __________; and the reactor period in reactor B will be __________.

A. higher; longer

B. higher; the same

C. the same; longer

D. the same; the same

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7036

A nuclear power plant is operating at steady-state 100 percent power when a reactor scram occurs. As a result of the scram, the core neutron flux will initially decrease on a period that is much ___________ than -80 seconds; and the period will become approximately -80 seconds about ___________ minutes after the scram.

A. longer; 3

B. longer; 30

C. shorter; 3

D. shorter; 30

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7618 (P7618)

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant reactor that experienced a reactor scram from extended full power operation at 0 seconds.

Which section(s) of the curve has/have a slope that is primarily determined by the production rate of delayed neutrons?

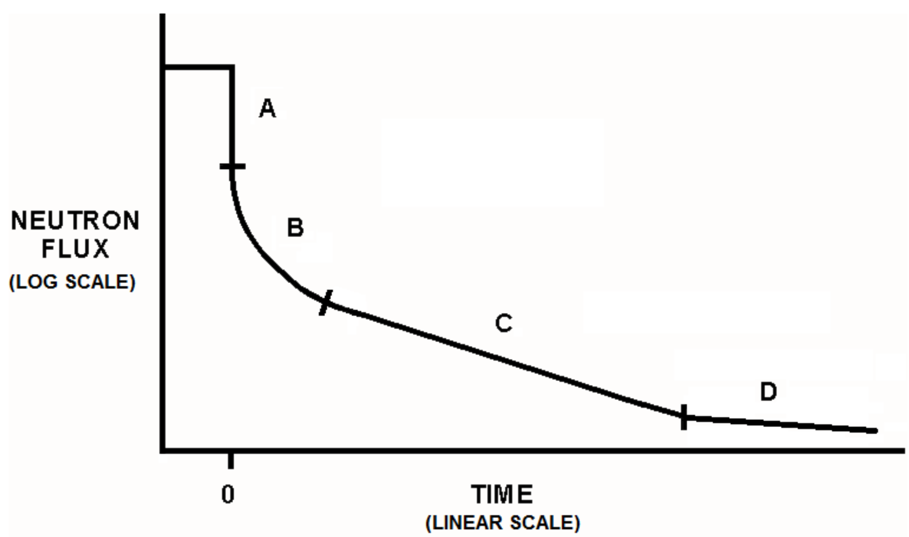
A. B only

B. B and C

C. C only

D. C and D

ANSWER: B.



TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7658 (P7658)

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant that experienced a reactor trip from extended full power operation at time = 0 seconds.

In which section of the curve does the production rate of source neutrons primarily determine the slope of the curve?

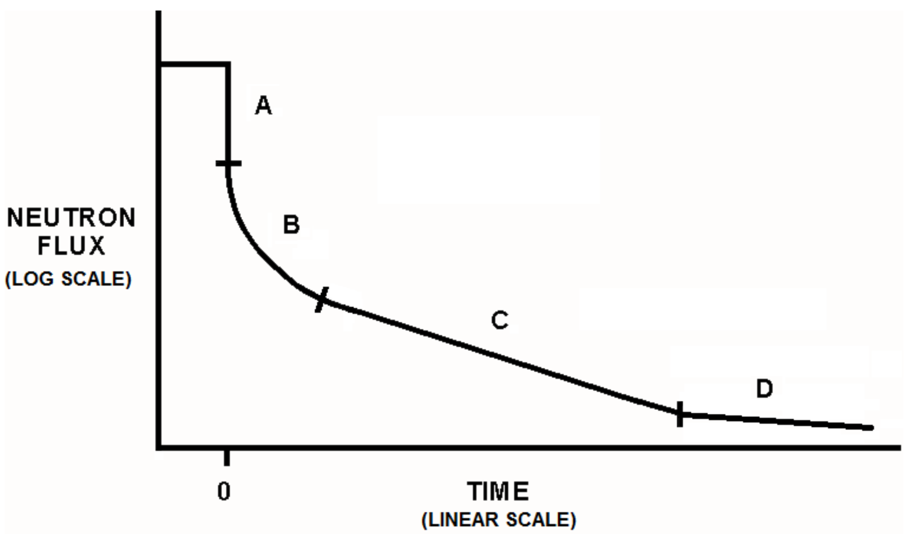
A. A

B. B

C. C

D. D

ANSWER: D.



TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7708 (P7708)

A reactor was operating for several months at 100 percent power when a reactor scram occurred. Which one of the following is primarily responsible for the reactor period value 2 minutes after the scram?

A. The K_{eff} in the core.

B. The rate of source neutron production in the core.

C. The effective delayed neutron fraction in the core.

D. The decay rates of the delayed neutron precursors in the core.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7738 (P7738)

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant that experienced a reactor scram from steady-state 100 percent power at time = 0 seconds.

The shape of section A on the graph is primarily determined by a rapid decrease in the production rate of…

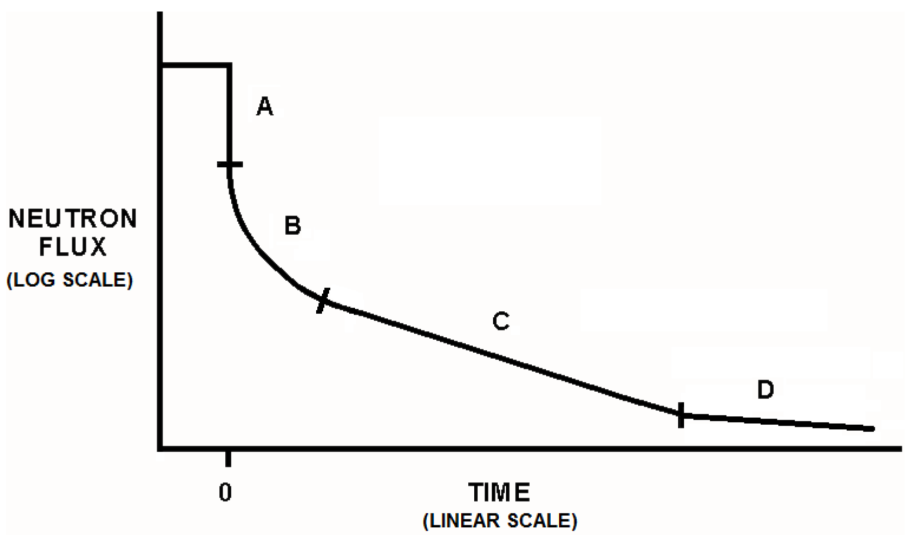
A. intrinsic source neutrons.

B. prompt fission neutrons.

C. delayed fission neutrons.

D. delayed fission neutron precursors.

ANSWER: B.



TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7758 (P7758)

A reactor was operating for several months at steady-state 100 percent power when a reactor scram occurred. Which one of the following lists the two factors most responsible for the value of the core neutron flux level 1 hour after the scram?

A. K_{eff} and the rate of source neutron production.

B. K_{eff} and the effective delayed neutron fraction.

C. The decay rates of the delayed neutron precursors and the rate of source neutron production.

D. The decay rates of the delayed neutron precursors and the effective delayed neutron fraction.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.25 [2.8/2.9]
QID: B7828 (P7828)

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant that experienced a reactor scram from steady-state 100 percent power at time = 0.

The shape of section B of the curve is determined primarily by the decreasing production rate of…

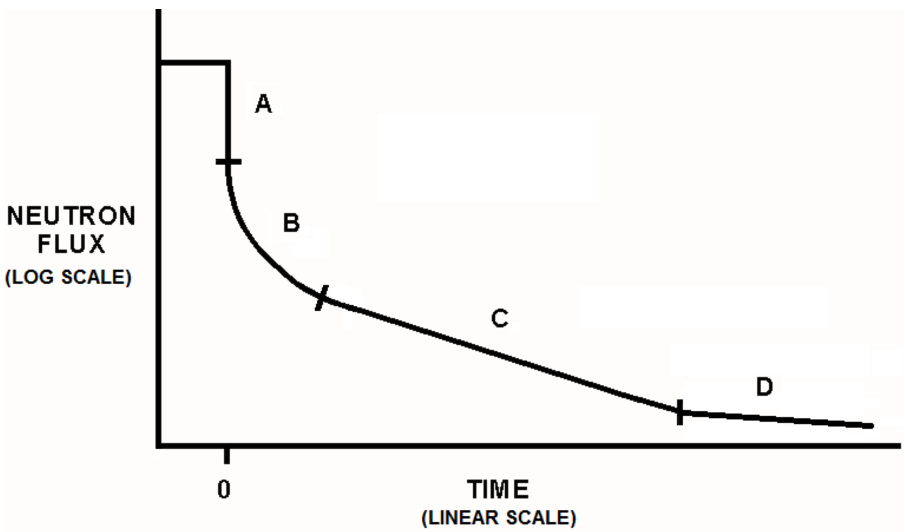
A. prompt fission neutrons.

B. delayed fission neutrons.

C. intrinsic source neutrons.

D. installed source neutrons.

ANSWER: B.



TOPIC: 292008
KNOWLEDGE: K1.26 [3.4/3.7]
QID: B471

A nuclear power plant is operating at steady-state 100 percent power. If a recirculation pump trips, which one of the following reactivity coefficients will cause the initial change in reactor power?

A. Void coefficient

B. Pressure coefficient

C. Moderator temperature coefficient

D. Fuel temperature (Doppler) coefficient

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.26 [3.4/3.7]
QID: B672

A nuclear power plant is operating at steady-state 70 percent of rated power when one recirculation pump trips. Reactor power will initially __________ because of the effects of the __________ coefficient.

A. decrease; void

B. increase; moderator temperature

C. decrease; moderator temperature

D. increase; void

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.27 [3.4/3.5]
QID: B126

Initially, a reactor is critical in the source range, when a fully-withdrawn control rod fully inserts into the core.

If no operator or automatic actions occur, the source range count rate will…

A. decrease to zero.

B. decrease to the count rate produced by the source neutron flux.

C. decrease to a count rate greater than that produced by the source neutron flux.

D. initially decrease, and then slowly increase and stabilize at the critical count rate.

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.27 [3.4/3.5]
QID: B1472

Initially, a nuclear power plant is operating at steady-state 100 percent power when a control rod fully inserts into the core. Assume the reactor does not scram. With no operator action, reactor power will initially decrease and then...

A. return to 100 percent with the void boundary lower in the core.

B. stabilize at a lower power level with the void boundary lower in the core.

C. return to 100 percent with the void boundary higher in the core.

D. stabilize at a lower power level with the void boundary higher in the core.

ANSWER: D.

TOPIC: 292008
KNOWLEDGE: K1.27 [3.4/3.5]
QID: B1969 (P672)

A reactor is critical below the point of adding heat when a fully withdrawn control rod fully inserts into the core. Assuming no operator or automatic actions, core neutron flux will slowly decrease to...

A. zero.

B. an equilibrium value less than the source neutron flux.

C. an equilibrium value greater than the source neutron flux.

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

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.27 [3.4/3.5]
QID: B7336

Initially, a nuclear reactor has a K_{eff} of 0.999 and a stable source range count rate. Then, control rods are inserted until K_{eff} decreases to 0.998, resulting in a negative reactor period. After the control rod insertion stops, reactor period will...

A. gradually lengthen until the neutron population reaches equilibrium, then stabilize at infinity.

B. gradually lengthen until the neutron population reaches equilibrium, then stabilize at an unknown negative value.

C. quickly stabilize at approximately negative 80 seconds until the neutron population approaches equilibrium, then gradually lengthen and stabilize at infinity.

D. quickly stabilize at an unknown negative value until the neutron population approaches equilibrium, then gradually lengthen and stabilize at an unknown negative value.

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.30 [3.2/3.5]
QID: B131 (P2672)

Which one of the following approximates the fission product decay heat produced in a reactor at one second and one hour following a reactor scram from long-term operation at 100 percent power?

	One Second	One Hour
A.	7 percent	1 percent
B.	7 percent	0.1 percent
C.	3 percent	1 percent
D.	3 percent	0.1 percent

ANSWER: A.

TOPIC: 292008
KNOWLEDGE: K1.30 [3.2/3.5]
QID: B372 (P370)

After one month of operation at 100 percent power, the fraction of rated thermal power being produced from the decay of fission products in a reactor is...

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.

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.30 [3.2/3.5]
QID: B2272 (P572)

A nuclear power plant has been operating at 100 percent power for several weeks when a reactor scram occurs. How much time will be required for core decay heat production to decrease to one percent power following the scram?

A. 1 to 8 seconds

B. 1 to 8 minutes

C. 1 to 8 hours

D. 1 to 8 days

ANSWER: C.

TOPIC: 292008
KNOWLEDGE: K1.30 [3.2/3.5]
QID: B2872

A reactor has been shut down for one day when a loss of all AC power results in a loss of forced cooling water flow through the reactor vessel (RV). Only ambient losses are removing heat from the reactor vessel.

Given the following information:

Reactor rated thermal power	= 2,800 MW
Decay heat rate	= 0.2 percent rated thermal power
RV ambient heat loss rate	= 2.4 MW
RV water specific heat	= 1.1 Btu/lbm-°F
RV water inventory	= 325,000 lbm

What will the average reactor vessel water heatup rate be during the 5 minutes immediately after forced cooling water flow is lost?

A. Less than 25°F/hour

B. 26 to 50°F/hour

C. 51 to 75°F/hour

D. More than 76°F/hour

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.30 [3.2/3.5]
QID: B2972 (P2972)

A nuclear power plant has been operating for one hour at 50 percent power following six months of operation at steady-state 100 percent power. What percentage of rated thermal power is currently being generated by fission product decay?

A. 1 percent to 2 percent

B. 3 percent to 5 percent

C. 6 percent to 8 percent

D. 9 percent to 11 percent

ANSWER: B.

TOPIC: 292008
KNOWLEDGE: K1.30 [3.2/3.5]
QID: B4336 (P4336)

A nuclear power plant had been operating at 100 percent power for six months when a reactor scram occurred. Which one of the following describes the source(s) of core heat generation 30 minutes after the reactor scram?

A. Fission product decay is the <u>only</u> significant source of core heat generation.

B. Delayed neutron-induced fission is the <u>only</u> significant source of core heat generation.

C. Fission product decay and delayed neutron-induced fission are <u>both</u> significant sources and produce approximately equal rates of core heat generation.

D. Fission product decay and delayed neutron-induced fission are <u>both</u> insignificant sources and generate core heat at rates that are less than the rate of ambient heat loss from the core.

ANSWER: A.