TOPIC: 292006
KNOWLEDGE: K1.01 [2.7/2.8]
QID: B558

Fission fragments or daughters that have a substantial neutron absorption cross section and are not fissionable are called...

A. fissile materials.

B. fission product poisons.

C. fissionable nuclides.

D. burnable poisons.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.01 [2.7/2.8]
QID: B1558 (P2858)

A fission product poison can be differentiated from all other fission products because a fission product poison...

A. has a higher microscopic cross section for thermal neutron capture.

B. has a longer half-life.

C. is produced in a greater percentage of thermal fissions.

D. is formed as a gas and is contained in the fuel pellets.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.01 [2.7/2.8]
QID: B1858 (P858)

Fission product poisons can be differentiated from other fission products in that fission product poisons...

A. have a longer half-life.

B. are stronger absorbers of thermal neutrons.

C. are produced in a larger percentage of fissions.

D. have a higher fission cross section for thermal neutrons.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.01 [2.7/2.8]
QID: B2061 (P2058)

A fission product poison can be differentiated from all other fission products in that a fission product poison will...

A. be produced in direct proportion to the fission rate in the core.

B. remain radioactive for thousands of years after the final reactor criticality.

C. depress the power production in some core locations and cause peaking in others.

D. migrate out of the fuel pellets and into the reactor coolant via pinhole defects in the clad.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.02 [3.1/3.1]
QID: B55

Which one of the following lists the proper order of substances from the largest to the smallest microscopic cross sections for absorption of thermal neutrons?

A. Gadolinium, U-235, Xe-135, U-238

B. Gadolinium, Xe-135, U-235, U-238

C. Xe-135, U-235, gadolinium, U-238

D. Xe-135, gadolinium, U-235, U-238

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.02 [3.1/3.1]
QID: B256 (P2658)

Compared to other poisons in the core, the two characteristics that cause Xe-135 to be a major reactor poison are its relatively _________ absorption cross section and its relatively _________ variation in concentration for large reactor power changes.

A. small; large

B. small; small

C. large; small

D. large; large

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.02 [3.1/3.1]
QID: B1058 (P1858)

Which one of the following is a characteristic of xenon-135 in a nuclear reactor core?

A. Thermal neutron flux level affects both the production and removal of xenon-135.

B. Thermal neutrons interact with xenon-135 primarily through scattering reactions.

C. Xenon-135 is primarily a resonance absorber of epithermal neutrons.

D. Xenon-135 is produced from the radioactive decay of barium-135.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.02 [3.1/3.1]
QID: B1259

Which one of the following exhibits the greatest microscopic cross section for absorption of a thermal neutron in an operating nuclear reactor?

A. Uranium-235

B. Uranium-238

C. Plutonium-239

D. Xenon-135

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.02 [3.1/3.1]
QID: B1658 (P2458)

Which one of the following exhibits the greatest microscopic cross section for absorption of a thermal neutron in an operating nuclear reactor core?

A. Uranium-235

B. Boron-10

C. Samarium-149

D. Xenon-135

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.02 [3.1/3.1]
QID: B3458

Nuclear reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating at end of core life (EOL) and reactor B is operating at beginning of core life (BOL).

Which reactor has the smaller <u>concentration</u> of equilibrium core Xe-135?

A. Reactor A (EOL) due to the smaller 100% power thermal neutron flux

B. Reactor A (EOL) due to the larger 100% power thermal neutron flux

C. Reactor B (BOL) due to the smaller 100% power thermal neutron flux

D. Reactor B (BOL) due to the larger 100% power thermal neutron flux

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.03 [2.9/2.9]
QID: B257 (P1859)

The major contributor to the production of Xe-135 in a nuclear reactor that has been operating at full power for 2 weeks is...

A. the radioactive decay of iodine.

B. the radioactive decay of promethium.

C. direct production from fission of U-235.

D. direct production from fission of U-238.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.03 [2.9/2.9]
QID: B362 (P358)

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

A. cesium-135.

B. iodine-135.

C. xenon-136.

D. iodine-136.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.03 [2.9/2.9]
QID: B458 (P1359)

A nuclear reactor has been operating at full power for several weeks. Xenon-135 is being directly produced as a fission product in approximately _________% of all fissions.

A. 100%

B. 30%

C. 3%

D. 0.3%

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.03 [2.9/2.9]
QID: B859 (P1559)

Which one of the following correctly describes the production mechanisms of Xe-135 in a nuclear reactor that is operating at steady-state 100% power?

A. Primarily from fission, secondarily from iodine decay

B. Primarily from fission, secondarily from promethium decay

C. Primarily from iodine decay, secondarily from fission

D. Primarily from promethium decay, secondarily from fission

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.03 [2.9/2.9]
QID: B2558 (P2558)

Nuclear reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating at the end of core life (EOL) and reactor B is operating at the beginning of core life (BOL).

Which reactor core has the greater <u>concentration</u> of Xe-135?

A. Reactor A (EOL) due to the smaller 100% power thermal neutron flux.

B. Reactor A (EOL) due to the larger 100% power thermal neutron flux.

C. Reactor B (BOL) due to the smaller 100% power thermal neutron flux.

D. Reactor B (BOL) due to the larger 100% power thermal neutron flux.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B128

Which one of the following describes the change in core xenon-135 concentration immediately following a power increase from equilibrium conditions?

A. Initially decrease due to the decreased rate of xenon-135 production from fission.

B. Initially decrease due to the increased rate of thermal neutron absorption by xenon-135.

C. Initially increase due to the increased rate of xenon-135 production from fission.

D. Initially increase due to the decreased rate of thermal neutron absorption by xenon-135.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B258

The two methods of Xe-135 removal from a nuclear reactor operating at full power are...

A. gamma decay and beta decay.

B. neutron absorption and fission.

C. fission and gamma decay.

D. beta decay and neutron absorption.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B359 (P1059)

Xenon-135 undergoes radioactive decay to...

A. iodine-135.

B. cesium-135.

C. tellurium-135.

D. lanthanum-135.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B462 (P460)

Reactor power is increased from 50% to 60% in 1 hour. The most significant contributor to the initial change in xenon reactivity is the increase in xenon...

A. production from iodine decay.

B. production from fission.

C. absorption of neutrons.

D. decay to cesium.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B860

Which one of the following values is the approximate half-life of Xe-135?

A. 19 seconds

B. 6.6 hours

C. 9.1 hours

D. 30 hours

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B959

Which one of the following describes the primary method of xenon-135 removal at the indicated steady state power level?

A. Decay of xenon-135 to cesium-135 at full power

B. Decay of xenon-135 to iodine-135 at the point of adding heat

C. Absorption of neutrons by xenon-135 at the point of adding heat

D. Absorption of neutrons by xenon-135 at full power

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.04 [2.9/2.9]
QID: B3358 (P2659)

A nuclear power plant has been operating at 100% power for several months. Which one of the following describes the relative contributions of beta decay and neutron capture to Xe-135 removal from the reactor core?

A. Primary - neutron capture; secondary - beta decay.

B. Primary - beta decay; secondary - neutron capture.

C. Beta decay and neutron capture contribute equally.

D. Not enough information is given to make a comparison.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B58 (P61)

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

A. Twice the 50% power concentration.

B. Less than twice the 50% power concentration.

C. More than twice the 50% power concentration.

D. Remains the same because it is independent of power.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B259 (P1459)

Following a two-week shutdown, a nuclear reactor is taken critical and ramped to full power in 6 hours. How long will it take to achieve an equilibrium xenon condition after the reactor reaches full power?

A. 70 to 80 hours

B. 40 to 50 hours

C. 8 to 10 hours

D. 1 to 2 hours

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B658 (P660)

A nuclear reactor was operating at 100% power for one week when power was decreased to 50%. Which one of the following describes the equilibrium core xenon-135 concentration at 50% power?

A. The same as the100% value.

B. More than one-half the 100% value.

C. Less than one-half the 100% value.

D. One-half the 100% value.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B1160 (P1158)

A nuclear reactor has been operating at 25% power for 24 hours following a 2-hour power reduction from steady-state full power. Which one of the following describes the current status of core xenon-135 concentration?

A. At equilibrium

B. Decreasing toward an upturn

C. Decreasing toward an equilibrium value

D. Increasing toward a peak value

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B1363

Which one of the following indicates that core Xe-135 is in equilibrium?

A. Xe-135 is being removed equally by neutron capture and decay.

B. The reactor has been operated at a steady-state power level for five days.

C. Xe-135 is being produced equally by fission and I-135 decay.

D. The reactor is currently operating at 100% power.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B1859

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

How much time at steady state 60% power will be required to reach equilibrium core xenon-135?

A. 20 to 30 hours

B. 40 to 50 hours

C. 70 to 80 hours

D. 90 to 100 hours

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B1960 (P1360)

A nuclear reactor has been operating at a constant power level for 15 hours following a rapid power reduction from 100% to 50%. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak.

B. Decreasing toward an upturn.

C. Increasing toward equilibrium.

D. Decreasing toward equilibrium.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B2659 (P2159)

Which one of the following indicates that core Xe-135 is in equilibrium?

A. Xe-135 production and removal rates are momentarily equal five hours after a power increase.

B. A reactor has been operated at 80% power for five days.

C. Xe-135 is being produced equally by fission and I-135 decay.

D. A reactor is currently operating at 100% power.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.05 [2.9/2.9]
QID: B2760 (P2859)

Nuclear reactors A and B are operating at steady-state 100% power with equilibrium core Xe-135. The reactors are identical except that reactor A is operating near the end of core life and reactor B is operating near the beginning of core life.

Which reactor is experiencing the most negative reactivity from equilibrium core Xe-135?

A. Reactor A due to a greater concentration of equilibrium core Xe-135.

B. Reactor A due to lower competition from the fuel for thermal neutrons.

C. Reactor B due to a greater thermal neutron flux in the core.

D. Reactor B due to a smaller accumulation of stable fission product poisons.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B59

A nuclear reactor has been operating at 50% power for one week when power is ramped over 4 hours to 100% power. How will the core xenon-135 concentration respond?

A. Decrease, and then build up to a higher equilibrium concentration

B. Increase, and then build up to a higher equilibrium concentration

C. Decrease, and then return to the same equilibrium concentration

D. Increase, and then return to the same equilibrium concentration

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B660

A nuclear reactor has been operating at 75% power for one week when power is decreased to 50% over a 1 hour period. Which one of the following statements explains how xenon concentration will initially change?

A. Decreases, because the xenon production rate from fission has decreased

B. Increases, because of the reduced rate of xenon burnout

C. Decreases, because the rate of xenon decay exceeds the rate of production from fission

D. Increases, because the concentration of iodine-135 increases

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B961

A nuclear reactor has been operating at 100% power for two weeks when power is reduced to 50% in 1 hour. How will the amount of core xenon change over the next 24 hours?

A. Increase and stabilize at a new higher value

B. Increase initially, then decrease and stabilize at a lower value

C. Decrease and stabilize at a new lower value

D. Decrease initially, then increase and stabilize at a higher value

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B1262 (P1960)

A nuclear reactor has been operating at 100% power for two weeks when power is decreased to 10% in 1 hour. Immediately following the power decrease, core xenon-135 concentration will ____________ for a period of ____________.

A. decrease; 4 to 6 hours

B. increase; 4 to 6 hours

C. decrease; 8 to 11 hours

D. increase; 8 to 11 hours

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B1860

A nuclear reactor has been operating at a steady-state power level for 15 hours following a rapid power reduction from 100% to 50%. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Increasing toward equilibrium

D. Decreasing toward equilibrium

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B2559 (P3362)

A nuclear reactor has been operating at 70% power for 26 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Decreasing toward equilibrium

D. At equilibrium

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B2761 (P2261)

A nuclear reactor has been operating at steady-state 50% power for 12 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Decreasing toward an upturn

C. Increasing toward equilibrium

D. Decreasing toward equilibrium

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.06 [2.7/2.7]
QID: B2960 (P2961)

A nuclear reactor has been operating at steady-state 30% power for 3 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak

B. Increasing toward equilibrium

C. Decreasing toward an upturn

D. Decreasing toward equilibrium

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.07 [3.2/3.2]
QID: B132

What is the difference in peak xenon concentration following a reactor scram after one week at 100% power as compared to a scram after one week at 50% power?

A. The time to reach the peak is shorter after 100% power than after 50% power, due to the higher iodine decay rate.

B. The peak from 50% is of a smaller magnitude due to the lower xenon burnout rate.

C. The peaks are equal because the decay rate of iodine remains constant.

D. The peak from 100% power is of a larger magnitude, due to the larger initial iodine concentration.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.07 [3.2/3.2]
QID: B260

A nuclear reactor has been operating at 25% power for five days when a scram occurs. Xe-135 will peak in approximately...

A. 2 hours.

B. 5 hours.

C. 10 hours.

D. 20 hours.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.07 [3.2/3.2]
QID: B861

Which one of the following equilibrium reactor prescram conditions requires the greater amount of control rod withdrawal to perform a reactor startup during peak xenon conditions after a reactor scram? (BOL = beginning of core life. EOL = end of core life.)

A. BOL and 100% power

B. EOL and 100% power

C. BOL and 20% power

D. EOL and 20% power

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.07 [3.2/3.2]
QID: B1361 (P1358)

A nuclear reactor has been operating at 75% power for two months. A manual reactor scram is required for a test. The scram will be followed immediately by a reactor startup with criticality scheduled to occur 12 hours after the scram.

The greatest assurance that fission product poison reactivity will permit criticality during the startup will exist if the reactor is operated at _____________ power for 48 hours prior to the scram and if criticality is rescheduled for _____________ hours after the scram.

A. 100%; 8

B. 100%; 16

C. 50%; 8

D. 50%; 16

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.07 [3.2/3.2]
QID: B1561 (P1561)

Select the combination below that completes the following statement.

The amount of control rod withdrawal needed to overcome peak core xenon-135 negative reactivity will be <u>smallest</u> after a reactor scram from equilibrium ________ reactor power at the ________ of core life.

A. 20%; beginning

B. 20%; end

C. 100%; beginning

D. 100%; end

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.07 [3.2/3.2]
QID: B3861 (P3860)

A nuclear reactor has been operating at 80% power for two months. A manual reactor scram is required for a test. The scram will be followed by a reactor startup with criticality scheduled to occur 24 hours after the scram.

The greatest assurance that xenon reactivity will permit criticality during the reactor startup will exist if the reactor is operated at ____________ power for 48 hours prior to the scram and if criticality is rescheduled for ____________ hours after the scram.

A. 60%; 18

B. 60%; 30

C. 100%; 18

D. 100%; 30

ANSWER: B.

TOPIC 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B135

When comparing control rod worth (CRW) during a reactor startup from 100% peak xenon-135 and a reactor startup from xenon-free conditions...

A. center CRW will be higher during the peak xenon startup than during the xenon-free startup.

B. peripheral CRW will be higher during the peak xenon startup than during the xenon-free startup.

C. center and peripheral CRWs will be the same regardless of core xenon conditions.

D. it is impossible to determine how xenon will affect the worth of center and peripheral control rods.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B261

A nuclear reactor has been operating at full power for several weeks when a scram occurs. When the reactor is brought critical 5 hours later, Xe-135 concentration will be highest in the ___________ of the core, which causes thermal neutron flux to shift toward the ____________ of the core.

A. center; periphery

B. periphery; periphery

C. center; center

D. periphery; center

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B1062

A nuclear reactor is operating at 100% power with equilibrium core xenon-135 near the beginning of a fuel cycle when a scram occurs. When the reactor is taken critical 5 hours later, xenon distribution will be maximum at the ______________ of the core.

A. bottom and center

B. bottom and outer circumference

C. top and center

D. top and outer circumference

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B2454

Sustained operation at 100% power requires periodic withdrawal of control rods to compensate for...

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

B. fuel depletion and buildup of fission product poisons.

C. decreasing control rod worth and burnable poison burnout.

D. burnable poison burnout and fuel depletion.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B2660 (P2359)

Which one of the following explains why core Xe-135 oscillations are a concern in a nuclear reactor?

A. They can adversely affect core power distribution and can require operation below full rated power.

B. They can adversely affect core power distribution and can prevent a reactor startup following a reactor scram.

C. They can cause excessively short reactor periods during power operation and can require operation below full rated power.

D. They can cause excessively short reactor periods during power operation and can prevent a reactor startup following a reactor scram.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B2860

A nuclear reactor has been operating at 50% power for several weeks near the middle of core life with core axial power distribution evenly divided above and below the core midplane. Reactor power is to be increased to 65% over a two-hour period using shallow control rods only.

During the power increase, core axial power distribution will...

A. shift toward the top of the core.

B. shift toward the bottom of the core.

C. remain evenly divided above and below the core midplane.

D. have peaks near the top and the bottom of the core.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.08 [2.8/3.2]
QID: B3061 (P3060)

A nuclear reactor has been operating at full power for one month following a refueling outage with core axial neutron flux distribution peaked in the bottom half of the core. An inadvertent reactor scram occurs. The reactor is restarted, with criticality occurring 6 hours after the scram. Reactor power is increased to 60% over the next 4 hours and stabilized.

How will core axial neutron flux distribution be affected during the 1-hour period immediately following the return to 60% power?

The core axial neutron flux peak will be located _______ in the core than the pre-scram peak location, and the flux peak will be moving ________.

A. higher; upward

B. higher; downward

C. lower; upward

D. lower; downward

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.09 [2.5/2.5]
QID: B262

A nuclear reactor is being started up and taken to rated power using a constant ramp rate following a one-month outage. To compensate for the effect of core xenon-135 while increasing reactor power, it will be necessary to ____________ rods and ___________ recirculation flow.

A. insert; decrease

B. insert; increase

C. withdraw; increase

D. withdraw; decrease

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.09 [2.5/2.5]
QID: B355 (P353)

A nuclear power plant is being returned to operation following a refueling outage. Fuel preconditioning requires reactor power to be increased from 10% to full power gradually over a one week period.

During this slow power increase, most of the positive reactivity added by the operator is required to overcome the negative reactivity from...

A. fuel burnup.

B. xenon buildup.

C. fuel temperature increase.

D. moderator temperature increase.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.09 [2.5/2.5]
QID: B562 (P561)

Following a seven day shutdown, a reactor startup is performed and a nuclear power plant is taken to 100% power over a 16-hour period. After reaching 100% power, what type of reactivity will the operator need to add to compensate for core xenon-135 changes over the next 24 hours?

A. Negative only

B. Negative, then positive

C. Positive only

D. Positive, then negative

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.09 [2.5/2.5]
QID: B2861 (P2260)

A nuclear reactor is initially shut down with no xenon in the core. Over the next four hours, the reactor is made critical and power level is increased to the point of adding heat. The shift supervisor has directed that power be maintained constant at this level for 12 hours for testing.

To accomplish this objective, control rods will have to be...

A. inserted periodically for the duration of the 12 hours.

B. withdrawn periodically for the duration of the 12 hours.

C. inserted periodically for 4 to 6 hours, then withdrawn periodically.

D. withdrawn periodically for 4 to 6 hours, then inserted periodically.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.10 [2.9/2.9]
QID: B57

Following a reactor scram from a long-term, steady-state, 100% power run, a reactor is to be taken critical. The calculated estimated critical conditions (position) are based on a xenon-free core.

Which one of the following is the shortest time after the initial scram that a xenon-free core will exist?

A. 8 to 10 hours

B. 15 to 25 hours

C. 40 to 50 hours

D. 70 to 80 hours

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.09 [2.5/2.5]
QID: B5631 (P5631)

A nuclear reactor was shut down for seven days to perform maintenance. A reactor startup was performed, and power level was increased from 1% to 50% over a two hour period.

Ten hours after reactor power reaches 50%, the magnitude of core xenon-135 negative reactivity will be...

A. increasing toward a downturn.

B. increasing toward an equilibrium value.

C. decreasing toward an equilibrium value.

D. decreasing toward an upturn.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.10 [2.9/2.9]
QID: B1162

A reactor scram recently occurred from steady state 100% power and a reactor startup is currently in progress. Which one of the following sets of initial startup conditions will require the most control rod withdrawal to achieve criticality? (BOC = beginning of fuel cycle; EOC = end of fuel cycle.)

	CORE AGE	TIME SINCE REACTOR SCRAM
A.	BOC	12 hours
B.	BOC	40 hours
C.	EOC	12 hours
D.	EOC	40 hours

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.10 [2.9/2.9]
QID: B1461 (P1462)

A nuclear reactor has been operating at 100% power for two months when a reactor scram occurs. Four hours later, the reactor is critical and stable at 10% power.

Which one of the following operator actions is required to maintain reactor power at 10% over the next 18 hours?

A. Add positive reactivity during the entire period

B. Add negative reactivity during the entire period

C. Add positive reactivity, then negative reactivity

D. Add negative reactivity, then positive reactivity

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.10 [2.9/2.9]
QID: B1763 (P1762)

A reactor startup is being conducted and criticality has been achieved 15 hours after a reactor scram from two months of operation at full power. After 1 additional hour, reactor power is stabilized at 10^{-4}% power and all control rod motion is stopped.

Which one of the following describes the response of reactor power over the next 2 hours without any further operator actions?

A. Power increases toward the point of adding heat due to the decay of Xe-135.

B. Power increases toward the point of adding heat due to the decay of Sm-149.

C. Power decreases toward the shutdown neutron level due to the buildup of Xe-135.

D. Power decreases toward the shutdown neutron level due to the buildup of Sm-149.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.10 [2.9/2.9]
QID: B4430

A reactor scram occurred from steady state 100% power and a reactor startup is currently in progress. Which one of the following sets of initial startup conditions will require the <u>smallest</u> amount of control rod withdrawal to achieve criticality? (BOC = beginning of fuel cycle; EOC = end of fuel cycle.)

	CORE AGE	TIME SINCE REACTOR SCRAM
A.	BOC	12 hours
B.	BOC	40 hours
C.	EOC	12 hours
D.	EOC	40 hours

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B173

A nuclear reactor has been operating at 50% power for four days. Power is then increased to 100% over a 1 hour period. How much time will be required for core xenon-135 concentration to reach its minimum value after the power increase?

A. 4 to 8 hours

B. 10 to 15 hours

C. 40 to 50 hours

D. 70 to 80 hours

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B459 (P260)

Two identical nuclear reactors have been operating at a constant power level for one week. Reactor A is at 50% power and reactor B is at 100% power. If both reactors scram at the same time, xenon-135 will peak first in reactor ______ and the highest xenon-135 reactivity peak will occur in reactor ______.

A. B; B

B. B; A

C. A; B

D. A; A

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B1362

A nuclear reactor has been operating at 100% power for two weeks when power is reduced to 50%. During the next 2 hours, what must the operator do to compensate for a change in core Xe-135?

A. The operator must add positive reactivity because Xe-135 is decaying.

B. The operator must add negative reactivity because Xe-135 is decaying.

C. The operator must add positive reactivity because Xe-135 is building in.

D. The operator must add negative reactivity because Xe-135 is building in.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B1759

Which one of the following describes the change in core xenon-135 concentration immediately following a 10% power increase from equilibrium 70% power over a two-hour period?

A. Xe-135 concentration will initially decrease due to the increased rate of decay of Xe-135 to Cs-135.

B. Xe-135 concentration will initially decrease due to the increased absorption of thermal neutrons by xenon-135.

C. Xe-135 concentration will initially increase due to the increased I-135 production rate directly from fission.

D. Xe-135 concentration will initially increase due to the increased production rate directly from fission.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B1761 (P1159)

Two identical nuclear reactors have been operating at a constant power level for one week. Reactor A is at 100% power and reactor B is at 50% power. If both reactors scram at the same time, xenon-135 concentration will peak first in reactor ______ and the highest peak xenon-135 concentration will occur in reactor ______.

A. B; B

B. B; A

C. A; B

D. A; A

ANSWER: B.

TOPIC: 292006
KNOWLEDGE K1.11 [2.6/2.7]
QID: B2063

A nuclear reactor had been operating at 50% power for two weeks when power was increased to 100% over a 3-hour period. To maintain reactor power stable during the next 24 hours, which one of the following incremental control rod manipulations will be required?

A. Withdraw rods slowly during the entire period

B. Withdraw rods slowly at first, then insert rods slowly

C. Insert rods slowly during the entire period

D. Insert rods slowly at first, then withdraw rods slowly

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B2158 (P2061)

A nuclear reactor had been operating at 100% power for two weeks when power was reduced to 50% over a 1-hour period. In order to maintain reactor power stable during the next 24 hours, which one of the following incremental control rod manipulations will be required?

A. Withdraw rods slowly during the entire period.

B. Withdraw rods slowly at first, then insert rods slowly.

C. Insert rods slowly during the entire period.

D. Insert rods slowly at first, then withdraw rods slowly.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B2259

Which one of the following describes the change in core xenon-135 concentration immediately following a power increase from 50% power equilibrium conditions?

A. Initially decreases due to the increased rate of xenon-135 radioactive decay.

B. Initially decreases due to the increased absorption of thermal neutrons by xenon-135.

C. Initially increases due to the increased xenon-135 production from fission.

D. Initially increases due to the increased iodine-135 production from fission.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B2361 (P2360)

A nuclear reactor had been operating at 70% power for two weeks when power was increased to 100% over a 2-hour period. To offset core Xe-135 reactivity changes during the next 12 hours, which one of the following incremental control rod manipulations will be required?

A. Withdraw rods slowly during the entire period.

B. Withdraw rods slowly at first, then insert rods slowly.

C. Insert rods slowly during the entire period.

D. Insert rods slowly at first, then withdraw rods slowly.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B2561 (P2559)

A nuclear reactor is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 50% over a 1- hour period. No subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 10 hours after the power change is completed?

A. Less than 50% and decreasing slowly.

B. Less than 50% and increasing slowly.

C. Greater than 50% and decreasing slowly.

D. Greater than 50% and increasing slowly.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B2762

A nuclear reactor is initially operating at 60% power with equilibrium core xenon-135. Power is increased to 80% over a 2-hour period. No subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 24 hours after the power change is completed?

A. Greater than 80% and decreasing slowly.

B. Greater than 80% and increasing slowly.

C. Less than 80% and decreasing slowly.

D. Less than 80% and increasing slowly.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B2862

A nuclear reactor has been operating at 50% power for 3 hours following a one-hour power reduction from steady-state 100% power. Which one of the following describes the current core xenon-135 concentration?

A. Increasing toward a peak.

B. Decreasing toward an upturn.

C. Increasing toward equilibrium.

D. Decreasing toward equilibrium.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.11 [2.6/2.7]
QID: B3259

A nuclear reactor is initially operating at equilibrium 100% power. An operator inserts control rods intermittently over a period of 30 minutes. At the end of this time period, reactor power is 70%.

Assuming no additional operator actions are taken, what will reactor power be after an additional 60 minutes?

A. 70% and stable.

B. Less than 70% and slowly increasing.

C. Less than 70% and slowly decreasing.

D. Less than 70% and stable.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B463

A nuclear reactor has been operating at 100% power for several weeks. Following a reactor scram the reactor first will be considered xenon-free after...

A. 40 to 50 hours.

B. 70 to 80 hours.

C. 100 to 110 hours.

D. 130 to 140 hours.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B1462

A reactor scram has occurred following two months operation at steady-state 100% power. How soon after the scram will the reactor first be considered xenon-free?

A. 8 to 10 hours

B. 24 to 30 hours

C. 40 to 50 hours

D. 70 to 80 hours

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B2159 (P1063)

A nuclear reactor has been operating at 100% power for three weeks when a reactor scram occurs. Which one of the following describes the concentration of Xe-135 in the core 24 hours after the scram?

A. At least 2 times the concentration at the time of the scram and decreasing.

B. Less than ½ the concentration at the time of the scram and decreasing.

C. At or approaching a peak value.

D. Approximately the same as at the time of the scram.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B2262 (P2462)

Twenty-four hours after a reactor scram from a long-term, steady-state, 100% power run, the core xenon-135 concentration will be approximately...

A. the same as at the time of the scram and decreasing.

B. the same as at the time of the scram and increasing.

C. 50% lower than at the time of the scram and decreasing.

D. 50% higher than at the time of the scram and increasing.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B2461 (P2262)

Fourteen hours after a reactor scram from 100% power equilibrium xenon conditions, the amount of core xenon-135 will be...

A. lower than 100% equilibrium xenon, and will have added a net positive reactivity since the scram.

B. lower than 100% equilibrium xenon, and will have added a net negative reactivity since the scram.

C. higher than 100% equilibrium xenon, and will have added a net positive reactivity since the scram.

D. higher than 100% equilibrium xenon, and will have added a net negative reactivity since the scram.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B2662 (P2662)

Given:

- A nuclear reactor was operating at 100% power for six weeks when a scram occurred.
- A reactor startup was performed and criticality was reached 16 hours after the scram.
- Two hours later, the reactor is currently at 30% power.

If no operator actions occur during the next hour, reactor power will ___________ because core Xe-135 concentration is ___________.

A. increase; decreasing

B. increase; increasing

C. decrease; decreasing

D. decrease; increasing

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.12 [2.8/2.3]
QID: B2763 (P2762)

A nuclear reactor that had been operating at 100% power for about two months was shutdown over a 2-hour period. Following the shutdown, core xenon-135 will reach a long-term steady-state concentration in ______________ hours.

A. 8 to 10

B. 20 to 25

C. 40 to 50

D. 70 to 80

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.13 [2.6/2.6]
QID: B63

If a nuclear reactor that has operated at 100% power for 10 days is shut down rapidly, xenon concentration will...

A. slowly decay away to almost zero in 3 days.

B. increase to a new equilibrium in 3 days.

C. peak in about a half day, then decay to almost zero in 3 days.

D. ramp down with reactor power.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.13 [2.6/2.6]
QID: B1463

Which one of the following describes a reason for the direction of change in core xenon-135 reactivity immediately after a reactor shutdown from long-term power operation?

A. The production rate of Xe-135 from I-135 decay significantly decreases.

B. The production rate of Xe-135 from fission significantly decreases.

C. The removal rate of Xe-135 by decay to I-135 significantly decreases.

D. The removal rate of Xe-135 by neutron absorption significantly decreases.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B56

A nuclear reactor has been shut down for two weeks after six months of full power operation. A reactor startup is performed and reactor power is stabilized at 10%. What control rod movement is required to maintain 10% stable power over the next 2 hours?

A. Small amounts of rod insertion to compensate for samarium depletion.

B. Small amounts of rod withdrawal to compensate for samarium buildup.

C. Small amounts of rod insertion to compensate for xenon burnout.

D. Small amounts of rod withdrawal to compensate for xenon buildup.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B62

A nuclear reactor that has been operating at 100% power for about two weeks has power reduced to 50% in 1 hour. To compensate for the change in xenon-135 during the next 4 hours, the operator must add...

A. negative reactivity to compensate for xenon building in.

B. negative reactivity because xenon is rapidly decaying away.

C. positive reactivity to compensate for xenon building in.

D. positive reactivity because xenon is rapidly decaying away.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B263

A nuclear reactor has been operating at full power for 10 weeks when a scram occurs. The reactor is made critical 24 hours later, and power level is maintained low in the intermediate range.

To maintain a constant power level for the next several hours, control rods must be...

A. inserted, because xenon burnout will cause increased neutron flux peaking near the periphery of the core.

B. maintained at the present height as xenon establishes its equilibrium value for this power level.

C. inserted, because xenon will approximately follow its normal decay curve.

D. withdrawn, because xenon concentration is increasing toward equilibrium.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B363 (P2260)

A nuclear reactor is initially shut down with no xenon in the core. The reactor is taken critical and 4 hours later power is in the middle of the intermediate range monitors, range 8. The maintenance department has asked that power be maintained constant at this level for approximately 12 hours.

To accomplish this, control rods will have to be...

A. withdrawn slowly for the duration of the 12 hours.

B. inserted slowly for the duration of the 12 hours.

C. withdrawn slowly for 4 to 6 hours, then inserted slowly.

D. inserted slowly for 4 to 6 hours, then withdrawn slowly.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B461

Four hours after a reactor scram from a long-term, steady-state, 100% power run, the reactor has been taken critical and is to be maintained at 1% to 2% power. Which one of the following operator actions is required?

A. Add positive reactivity because xenon is building in

B. Add negative reactivity because xenon is building in

C. Add negative reactivity because xenon is decaying away

D. Add positive reactivity because xenon is decaying away

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B964 (P2262)

Sixteen hours after a reactor scram from 100% power, equilibrium xenon condition, the amount of core xenon will be...

A. lower than 100% equilibrium xenon, and will have added a net positive reactivity since the scram.

B. higher than 100% equilibrium xenon, and will have added a net positive reactivity since the scram.

C. lower than 100% equilibrium xenon, and will have added a net negative reactivity since the scram.

D. higher than 100% equilibrium xenon, and will have added a net negative reactivity since the scram.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B1164

A nuclear reactor is operating at 100% power with equilibrium xenon conditions at the beginning of a fuel cycle when a reactor scram occurs. The reactor is taken critical 4 hours later.

Which one of the following describes the effect of xenon on control rod worth when the reactor becomes critical?

A. Increasing xenon concentration at the periphery of the core will cause periphery rods to exhibit high-worth characteristics.

B. Peak thermal flux at the periphery of the core will cause periphery rods to exhibit high-worth characteristics.

C. Peak thermal flux at the center of the core will cause center rods to exhibit high-worth characteristics.

D. Decreasing xenon concentration at the center of the core will cause center control rods to exhibit high-worth characteristics.

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B1663

A reactor is initially operating at 50% power with equilibrium core xenon-135. Power is increased to 75% over a 1 hour period with no subsequent operator actions. Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 6 hours after the power change?

A. Greater than 75% and decreasing slowly

B. Greater than 75% and increasing slowly

C. Lower than 75% and decreasing slowly

D. Lower than 75% and increasing slowly

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B1762

A nuclear reactor is operating at 100% power with equilibrium xenon conditions at the beginning of a fuel cycle when a reactor scram occurs. The reactor is taken critical 4 hours later.

Which one of the following describes the effect of core xenon-135 on control rod worth when the reactor becomes critical?

A. High xenon-135 concentration at the periphery of the core will cause periphery rods to exhibit relatively high-worth characteristics.

B. High xenon-135 concentration at the periphery of the core will cause central rods to exhibit relatively high-worth characteristics.

C. High xenon-135 concentration at the center of the core will cause peripheral rods to exhibit relatively high-worth characteristics.

D. High xenon-135 concentration at the center of the core will cause central rods to exhibit relatively high-worth characteristics.

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B1862 (P361)

A nuclear power plant has been operating at 100% power for two months when a reactor scram occurs. Shortly after the reactor scram a reactor startup is commenced. Six hours after the scram, reactor power is at 2%. To maintain power stable at 2% over the next hour, the operator must add...

A. positive reactivity because core xenon-135 is building up.

B. negative reactivity because core xenon-135 is building up.

C. positive reactivity because core xenon-135 is decaying away.

D. negative reactivity because core xenon-135 is decaying away.

ANSWER: A.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B2062

A nuclear reactor is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 75% over a 1-hour period and stabilized. No subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 10 hours after the power change?

A. Greater than 75% and decreasing slowly

B. Greater than 75% and increasing slowly

C. Less than 75% and decreasing slowly

D. Less than 75% and increasing slowly

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B2263

A nuclear reactor is operating at 80% power following a power reduction from 100% over a one-hour period. To keep reactor power at 80% over the next three hours, the operator must ________ control rods or _________ reactor recirculation flow rate.

A. insert; increase

B. insert; decrease

C. withdraw; increase

D. withdraw; decrease

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B2964 (P2963)

A nuclear reactor is operating at 60% power immediately after a one-hour power increase from equilibrium 40% power. To keep reactor power at 60% over the next two hours, the operator must ________ control rods or _________ reactor recirculation flow rate.

A. insert; increase

B. insert; decrease

C. withdraw; increase

D. withdraw; decrease

ANSWER: B.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B3063

A nuclear reactor is initially operating at 100% power with equilibrium core xenon-135. Power is decreased to 75% over a 1-hour period and stabilized. No subsequent operator actions are taken.

Considering only the reactivity effects of core xenon-135 changes, which one of the following describes reactor power 30 hours after the power change?

A. Less than 75% and increasing slowly

B. Less than 75% and decreasing slowly

C. Greater than 75% and increasing slowly

D. Greater than 75% and decreasing slowly

ANSWER: C.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B3563 (P3563)

A nuclear power plant had been operating at 100% power for two months when a reactor scram occurred. Soon afterward, a reactor startup was performed. Twelve hours after the scram, the startup has been paused with reactor power at 2%.

To maintain reactor power stable at 2% over the next hour, the operator must add ___________ reactivity because core xenon-135 concentration will be _____________.

A. positive; increasing.

B. negative; increasing.

C. positive; decreasing.

D. negative; decreasing.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B3863

A nuclear power plant has been operating at steady-state 100% reactor power for three weeks when the operator slowly adds negative reactivity to the core over a period of 15 minutes to lower power level to 90%. Which one of the following describes reactor power 60 minutes later if no additional operator action is taken?

A. Higher than 90% and increasing slowly.

B. Higher than 90% and decreasing slowly.

C. Lower than 90% and increasing slowly.

D. Lower than 90% and decreasing slowly.

ANSWER: D.

TOPIC: 292006
KNOWLEDGE: K1.14 [3.1/3.2]
QID: B4631

Six hours after a reactor scram from equilibrium full power operation, a nuclear reactor is taken critical and power is immediately stabilized. To maintain the reactor critical at a constant power level for the next hour, the operator must add __________ reactivity because core Xe-135 concentration is __________.

A. negative; increasing

B. negative; decreasing

C. positive; increasing

D. positive; decreasing

ANSWER: C.