TOPIC: 292007
KNOWLEDGE: K1.01 [2.9/3.1]
QID: B64

What is the definition of a "burnable poison?"

A. Isotopes manufactured into the fuel with large-scatter macroscopic cross sections to improve neutron thermalization.

B. Thermal neutron absorbing material added to the fuel during manufacturing to increase initial core fuel load.

C. Thermal neutron absorbing material produced in the non-fissionable fuel isotopes by fast neutron absorption.

D. Fast neutron absorbing material loaded into the upper one-third of the core to aid in flattening the thermal neutron flux.

ANSWER: B.

TOPIC: 292007
KNOWLEDGE: K1.01 [2.9/3.1]
QID: B136

Burnable poisons are placed in a nuclear reactor core to...

A. increase the amount of fuel that can be loaded into the core.

B. accommodate control rod depletion that occurs over core life.

C. compensate for the buildup of xenon-135 that occurs over core life.

D. ensure that the reactor will always operate in an undermoderated condition.

ANSWER: A.

TOPIC: 292007
KNOWLEDGE: K1.01 [2.9/3.1]
QID: B264

Burnable poisons are loaded into the core to...

A. reduce the rod shadowing effect between shallow rods early in core life.

B. provide for flux shaping in areas of deep rods during high power operation.

C. increase the excess reactivity that can be loaded into the core during refueling.

D. ensure the moderator coefficient of reactivity remains negative throughout core life.

ANSWER: C.

TOPIC: 292007
KNOWLEDGE: K1.01 [2.9/3.1]
QID: B364 (P362)

Which one of the following is not a function performed by burnable poisons in an operating nuclear reactor?

A. Provide neutron flux shaping.

B. Provide more uniform power density.

C. Offset the effects of control rod burnout.

D. Allow higher fuel enrichment of initial core load.

ANSWER: C.

TOPIC: 292007
KNOWLEDGE: K1.01 [2.9/3.1]
QID: B1265

Gadolinium (Gd-155 and -157) is used instead of boron (B-10) as the ____________ material; when compared to gadolinium, boron has a much ____________ cross section for absorbing thermal neutrons.

A. control rod; larger

B. burnable poison; larger

C. control rod; smaller

D. burnable poison; smaller

ANSWER: D.

TOPIC: 292007
KNOWLEDGE: K1.01 [2.9/3.1]
QID: B2564 (P2164)

Why are burnable poisons installed in a nuclear reactor core?

A. To shield reactor fuel from thermal neutron flux until later in core life

B. To compensate for control rod burnout that occurs over core life

C. To flatten the radial thermal neutron flux distribution at the end of core life

D. To ensure a negative moderator temperature coefficient early in core life

ANSWER: A.

TOPIC: 292007
KNOWLEDGE: K1.03 [2.4/2.7]
QID: B564 (P264)

Just prior to refueling, control rods are nearly fully withdrawn at 100% power. After refueling, the control rods are inserted much farther into the core at 100% power.

Which one of the following is the primary reason for the change in full power control rod position?

A. Reactivity from power defect at beginning of core life (BOL) is much greater than at end of core life (EOL).

B. Reactivity from void coefficient at EOL is much greater than at BOL.

C. The excess reactivity in the core at BOL is much greater than at EOL.

D. The integral control rod worth at EOL is much greater than at BOL.

ANSWER: C.

TOPIC: 292007
KNOWLEDGE: K1.03 [2.4/2.7]
QID: B1163 (P1264)

Refer to the drawing of K_{eff} versus core age for a nuclear reactor core following a refueling outage (see figure below).

Which one of the following is responsible for the majority of the decrease in K_{eff} from point 1 to point 2?

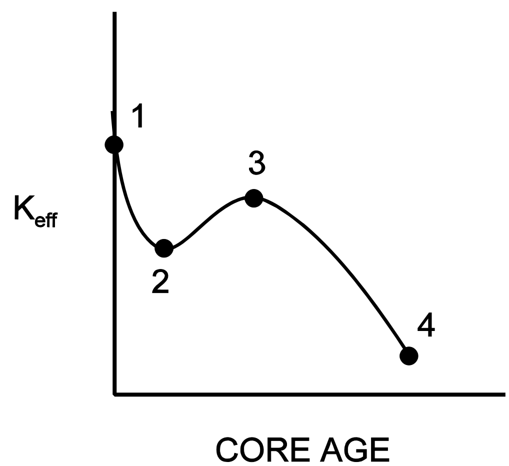
A. Depletion of fuel

B. Burnout of burnable poisons

C. Initial heat-up of the reactor

D. Buildup of fission product poisons

ANSWER: D.



TOPIC: 292007
KNOWLEDGE: K1.03 [2.4/2.7]
QID: B1364 (P1864)

Refer to the drawing of K_{eff} versus core age (see figure below).

The change in K_{eff} from point 2 to point 3 is caused by...

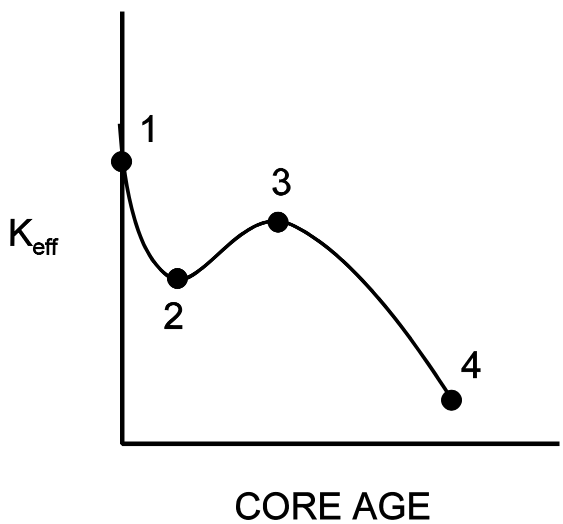
A. depletion of fuel.

B. depletion of control rods.

C. burnout of burnable poisons.

D. burnout of fission product poisons.

ANSWER: C.



TOPIC: 292007
KNOWLEDGE: K1.03 [2.4/2.7]
QID: B1563

Refer to the drawing of K_{eff} versus core age (see figure below).

The major cause for the change in K_{eff} from point 3 to point 4 is...

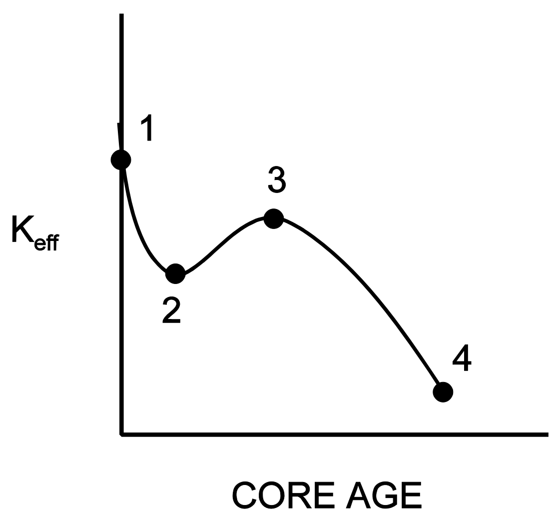
A. depletion of U-235.

B. depletion of U-238.

C. burnout of burnable poisons.

D. buildup of fission product poisons.

ANSWER: A.



TOPIC: 292007
KNOWLEDGE: K1.03 [2.4/2.7]
QID: B3264

Refer to the curve of K_{eff} versus core age for an operating nuclear reactor (see figure below).

The reactor has been operating at 100% power for several weeks and is currently operating between points 2 and 3 on the curve.

Assuming reactor recirculation flow rate remains the same, what general control rod operation will be necessary to maintain the reactor operating at 100% power until point 3 is reached?

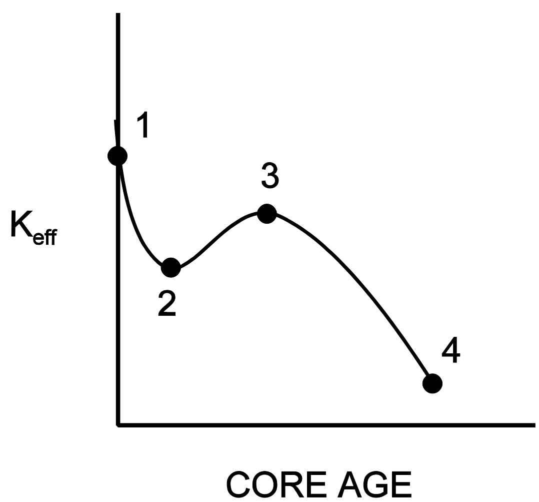
A. Withdrawal for the entire period.

B. Withdrawal at first, then insertion.

C. Insertion for the entire period.

D. Insertion at first, then withdrawal.

ANSWER: C.



TOPIC: 292007
KNOWLEDGE: K1.03 [2.4/2.7]
QID: B4832

Just prior to a refueling outage the control rod density at 100% power is relatively low. However, immediately following the outage the control rod density at 100% power is much higher.

Which one of the following contributes to the need for a much higher 100% power control rod density at the beginning of a fuel cycle (BOC) compared with the end of a fuel cycle (EOC)?

A. The negative reactivity from burnable poisons is greater at BOC than at EOC.

B. The negative reactivity from fission product poisons is smaller at BOC than at EOC.

C. The positive reactivity from the fuel in the core is smaller at BOC than at EOC.

D. The positive reactivity from a unit withdrawal of a typical control rod is greater at BOC than at EOC.

ANSWER: B.