TOPIC: 192007
KNOWLEDGE: K1.01 [2.1/2.5]
QID: P362 (B364)

Which one of the following is <u>not</u> a function performed by burnable poisons in an operating reactor?

A. Provide neutron flux shaping.

B. Provide more uniform power density.

C. Offset the effects of control rod burnout.

D. Allow higher enrichment of new fuel assemblies.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.01 [2.1/2.5]
QID: P671

A major reason for installing burnable poisons in a reactor is to…

A. decrease the amount of fuel required to produce a given amount of heat.

B. decrease the amount of fuel required to produce a given duration of plant operation.

C. allow more fuel to be loaded to prolong a fuel cycle.

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

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.01 [2.1/2.5]
QID: P864

Instead of using only a higher reactor coolant boron concentration to offset the enrichment of new fuel assemblies, burnable poisons are installed in a new reactor core to...

A. prevent boron precipitation during normal operation.

B. establish a more negative moderator temperature coefficient.

C. allow control rods to be farther withdrawn upon initial criticality.

D. maintain reactor coolant pH above a minimum acceptable value.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.01 [2.1/2.5]
QID: P1664

Why are burnable poisons installed in a new reactor core <u>instead</u> of simply using a higher reactor coolant boron concentration for reactivity control?

A. To prevent boron precipitation during normal operation.

B. To establish a more negative moderator temperature coefficient.

C. To minimize the distortion of the neutron flux distribution caused by soluble boron.

D. To allow the loading of excessive reactivity in the form of higher fuel enrichment.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P64

A reactor is operating near the end of its fuel cycle. Reactor power and reactor coolant system (RCS) temperature are being allowed to "coast down."

Why is RCS boron dilution no longer used for reactivity control for this reactor?

A. The magnitude of the differential boron worth (ΔK/K/ppm) has increased so much that reactivity changes from RCS boron dilution cannot be safely controlled by the operator.

B. The magnitude of the differential boron worth (ΔK/K/ppm) has decreased so much that a very large amount of water must be added to the RCS to make a small positive reactivity addition to the core.

C. The RCS boron concentration has become so high that a very large amount of boron must be added to produce a small increase in boron concentration.

D. The RCS boron concentration has become so low that a very large amount of water must be added to the RCS to produce a small decrease in boron concentration.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P264

Just prior to a refueling outage, a nuclear power plant was operating at 100 percent power with a reactor coolant boron concentration of 50 ppm. After the refueling outage, the 100 percent power boron concentration is approximately 1,000 ppm.

Which one of the following is the primary reason for the large increase in 100 percent power reactor coolant boron concentration?

A. The negative reactivity from power defect after the outage is much greater than before the outage.

B. The magnitude of differential boron worth (ΔK/K/ppm) after the outage is much less than before the outage.

C. The excess reactivity in the core after the outage is much greater than before the outage.

D. The magnitude of integral control rod worth after the outage is much less than before the outage.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P464

During a six-month period of continuous 100 percent power operation in the middle of a fuel cycle, the reactor coolant boron concentration must be decreased periodically 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.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P1264 (B1163)

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

The major cause for the change in K_{eff} from point 1 to point 2 is the…

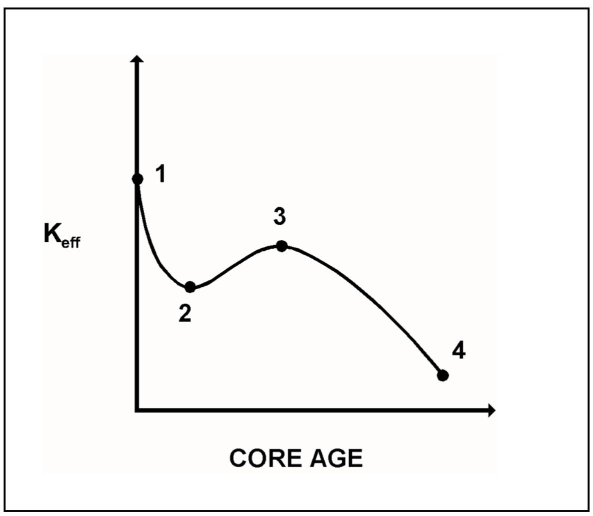
A. depletion of fuel.

B. burnout of burnable poisons.

C. initial heatup of the reactor.

D. buildup of fission product poisons.

[redacted]



TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P1563

Refer to the graph of critical boron concentration versus burnup for a reactor following a refueling outage (See figure below.).

Which one of the following is primarily responsible for the shape of the curve from the middle of core life to the end of core life?

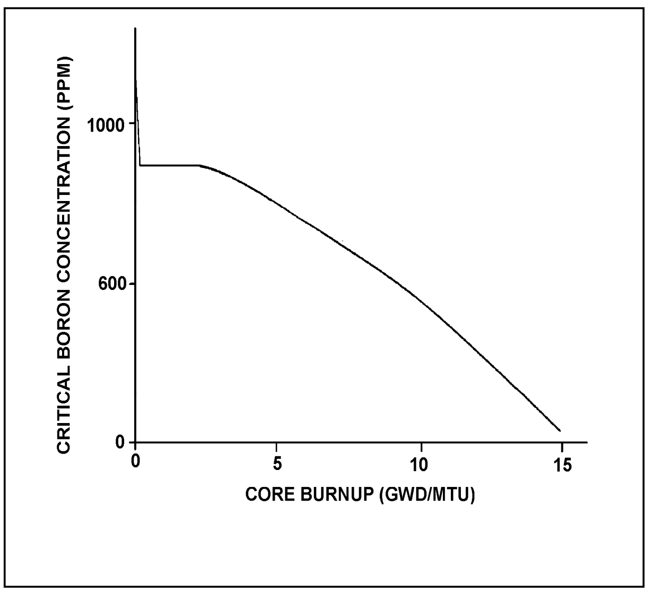
A. Fuel depletion

B. Fission product buildup

C. Burnable poison burnout

D. Conversion of U-238 to Pu-239

[redacted]



TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P1864

Refer to the graph of critical boron concentration versus core burnup for a reactor during its first fuel cycle (see figure below).

Which one of the following explains why reactor coolant critical boron concentration becomes relatively constant for a period early in the fuel cycle?

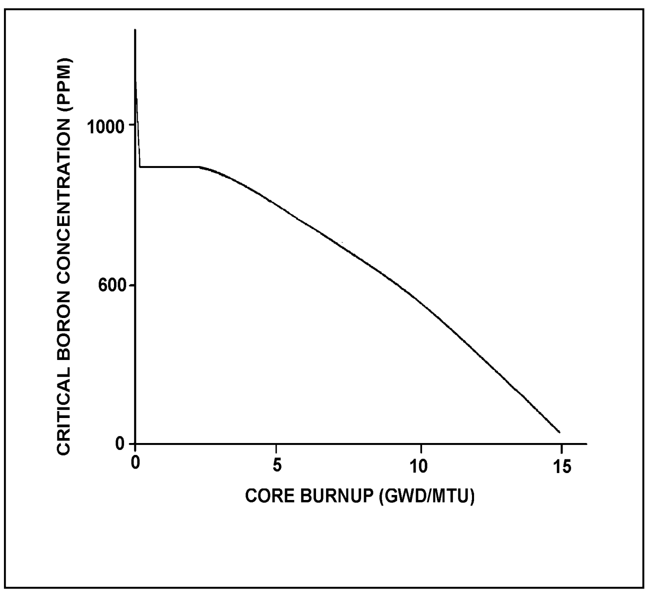
A. Fission product poison buildup is being offset by burnable poison burnout and fuel depletion.

B. Fission product poison buildup and fuel depletion are being offset by burnable poison burnout.

C. Fuel depletion is being offset by the buildup of fissionable plutonium and fission product poisons.

D. Fuel depletion and burnable poison burnout and are being offset by the buildup of fission product poisons.

[redacted]



TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P2763

During continuous 100 percent power operation in the middle of a fuel cycle, the reactor coolant boron concentration must be decreased periodically to compensate for fuel depletion. What other core age-related factor requires a periodic decrease in reactor coolant boron concentration?

A. Decreasing control rod worth.

B. Buildup of fission product poisons.

C. Burnout of burnable poisons.

D. Decreasing fuel temperature.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P2964

A reactor has been operating at 100 percent power for three months following a refueling outage. If the reactor is operated at 100 percent power without making RCS boron additions or dilutions for the next month, RCS boron concentration will...

A. decrease, because boron atoms decompose at normal RCS operating temperatures.

B. decrease, because irradiated boron-10 atoms undergo a neutron-alpha reaction.

C. remain constant, because irradiated boron-10 atoms become stable boron-11 atoms.

D. remain constant, because irradiated boron-10 atoms still have large absorption cross sections for thermal neutrons.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P4832

Just prior to a refueling outage, the reactor coolant boron concentration at 100 percent power was 50 ppm. Burnable poisons were installed during the outage. Immediately following the outage, the boron concentration at 100 percent power was 1,000 ppm.

Which one of the following contributes to the need for a much higher 100 percent power reactor coolant boron concentration after the outage?

A. The negative reactivity from burnable poisons after the outage is greater than before the outage.

B. The negative reactivity from fission product poisons after the outage is smaller than before the outage.

C. The positive reactivity from the fuel in the core after the outage is smaller than before the outage.

D. The positive reactivity from a unit withdrawal of a typical control rod after the outage is greater than before the outage.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.04 [3.1/3.4]
QID: P7532

A nuclear power plant had been shut down for two weeks near the middle of a fuel cycle when a reactor startup was commenced. Twelve hours later, reactor power is 100 percent, where it is being maintained. Which one of the following is the primary reason for periodically reducing the reactor coolant boron concentration during the next 36 hours?

A. To offset the buildup of xenon-135.

B. To offset the depletion of the reactor fuel.

C. To maintain an adequate shutdown margin.

D. To maintain reactor heat flux below the critical heat flux.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.05 [3.0/3.2]
QID: P1964

Which one of the following describes whether reactor power can be increased from 50 percent to 100 percent in a controlled manner faster near the beginning of core life (BOL) or near the end of core life (EOL)? (Assume all control rods are fully withdrawn just prior to beginning the power increase.)

A. Faster near EOL, because faster changes in boron concentration are possible.

B. Faster near EOL, because integral control rod worth is greater.

C. Faster near BOL, because faster changes in boron concentration are possible.

D. Faster near BOL, because integral control rod worth is greater.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.05 [3.0/3.2]
QID: P2053

Which one of the following correctly compares the rates at which reactor power can be safely increased from 80 percent to 100 percent at the beginning of a fuel cycle (BOC) versus at the end of a fuel cycle (EOC)?

A. Slower at EOC, due to a lower maximum rate of reactor coolant boron dilution.

B. Slower at EOC, due to a less negative differential control rod worth.

C. Slower at BOC, due to a lower maximum rate of reactor coolant boron dilution.

D. Slower at BOC, due to a less negative differential control rod worth.

[redacted]

TOPIC: 192007
KNOWLEDGE: K1.05 [3.0/3.2]
QID: P3364

Compared to adding boric acid to the reactor coolant system (RCS) during forced circulation, adding boric acid during natural circulation requires __________ time to achieve complete mixing in the RCS; and after complete mixing occurs, a 1 ppm increase in RCS boron concentration during natural circulation will cause a/an __________ change in reactivity for a given reactor coolant temperature.

A. more; smaller

B. more; equal

C. less; smaller

D. less; equal

[redacted]