TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P97 (B899)

A pressure stress applied to the reactor vessel is...

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

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

C. tensile across the entire wall.

D. compressive across the entire wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P296

Brittle fracture is the fragmentation of metal resulting from the application of _____________ stress at relatively _____________ temperatures.

A. compressive; high

B. compressive; low

C. tensile; high

D. tensile; low

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P397 (B398)

Brittle fracture of the reactor coolant system pressure boundary is most likely to occur at...

A. 120°F and 2200 psig.

B. 120°F and 400 psig.

C. 400°F and 2200 psig.

D. 400°F and 400 psig.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P497 (B499)

Which one of the following comparisons will result in a higher probability of brittle fracture of the reactor vessel?

A. A high reactor gamma flux rather than a high neutron flux.

B. A high reactor vessel material strength rather than a high material ductility.

C. A high reactor coolant oxygen content rather than a low oxygen content.

D. A rapid 100°F reactor cooldown at a high temperature rather than a low temperature.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1200

Which one of the following reduces the probability of brittle fracture of the reactor vessel?

A. The presence of a preexisting flaw

B. The presence of a tensile stress

C. Operation at low temperatures

D. Small heatup and cooldown rates

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1296

Which one of the following comparisons increases the probability of brittle fracture of a pressure vessel wall?

A. A high temperature rather than a low temperature.

B. A tensile stress rather than a compressive stress.

C. Performing a 100°F/hour heatup rather than a 100°F/hour cooldown.

D. Using materials fabricated from stainless steel rather than carbon steel.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1396

Which one of the following statements describes the relationship between brittle fracture and nil-ductility temperature?

A. Operation below the nil-ductility temperature will result in brittle fracture.

B. Operation above the nil-ductility temperature will result in brittle fracture.

C. Operation below the nil-ductility temperature will increase the probability of brittle fracture.

D. Operation above the nil-ductility temperature will increase the probability of brittle fracture.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1597 (B1899)

Which one of the following comparisons increases the probability of brittle fracture for a reactor pressure vessel wall?

A. Using materials fabricated from stainless steel rather than carbon steel.

B. A compressive stress rather than a tensile stress.

C. A high reactor coolant temperature rather than a low reactor coolant temperature.

D. Performing a 100°F/hr cooldown rather than a 100°F/hr heatup.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1696 (B2700)

Which one of the following comparisons increases the probability of brittle fracture of a reactor pressure vessel wall?

A. Performing a 50°F/hr cooldown at 1600 psia rather than a 50°F/hr cooldown at 1200 psia.

B. A compressive stress rather than a tensile stress across the vessel wall.

C. A high reactor coolant temperature rather than a low reactor coolant temperature.

D. Changing wall design to increase toughness while maintaining the same strength.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1796

Brittle fracture of the reactor coolant system pressure boundary is <u>least likely</u> to occur at...

A. 120°F and 2,200 psig.

B. 120°F and 400 psig.

C. 400°F and 2,200 psig.

D. 400°F and 400 psig.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P1896 (B1299)

Brittle fracture of the reactor vessel (RV) is most likely to occur during a ____________ of the reactor coolant system (RCS) when RCS temperature is ____________ the RV reference temperature for nil-ductility transition (RT_{NDT}).

A. heatup; above

B. heatup; below

C. cooldown; above

D. cooldown; below

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2096 (B2099)

Which one of the following will prevent brittle fracture failure of a reactor vessel?

A. Manufacturing the reactor vessel from low carbon steel.

B. Maintaining reactor vessel pressure below the maximum design limit.

C. Operating above the reference temperature for nil-ductility transition (RT_{NDT}).

D. Maintaining the number of reactor vessel heatup/cooldown cycles within limits.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2196

Brittle fracture of the reactor vessel (RV) is <u>least</u> likely to occur during a _____________ of the RV when RV temperature is _____________ the reference temperature for nil-ductility transition (RT_{NDT}).

A. cooldown; above

B. heatup; above

C. cooldown; below

D. heatup; below

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2496 (B2499)

Brittle fracture of a low-carbon steel is more likely to occur when the temperature of the steel is ___________ the nil ductility temperature, and will normally occur when the applied stress is ___________ the steel's yield strength (or yield stress).

A. greater than; greater than

B. greater than; less than

C. less than; greater than

D. less than; less than

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2497 (B2500)

Which one of the following comparisons will result in a higher probability of brittle fracture failure of the reactor vessel?

A. An RCS pH of 8.5 rather than 9.0

B. A high reactor coolant oxygen content rather than a low oxygen content

C. A 50°F/hr RCS cooldown rather than a 100°F/hr heatup

D. A high gamma flux rather than a high neutron flux

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.01 [2.8/3.2]
QID: P2896

Which one of the following comparisons will result in a lower probability of brittle fracture failure of the reactor vessel?

A. An RCS pH of 9.0 rather than 8.5

B. A low reactor coolant oxygen content rather than a high oxygen content

C. A 50°F/hr RCS cooldown rather than a 100°F/hr heatup

D. A high gamma flux rather than a high neutron flux

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P98

The nil-ductility temperature is that temperature...

A. below which the probability of brittle fracture significantly increases.

B. determined by fracture mechanics to be equivalent to reference transition temperature.

C. determined by Charpy V-notch test to be equivalent to reference transition temperature.

D. below which the yield stress of the metal is inversely proportional to Young's modulus of elasticity.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P597 (B2699)

The nil-ductility transition temperature of the reactor vessel (RV) is the temperature...

A. above which the RV metal will elastically deform as RCS pressure decreases.

B. above which the RV metal loses its ability to elastically deform as RCS pressure increases.

C. below which the RV metal will elastically deform as reactor coolant system (RCS) pressure decreases.

D. below which the RV metal loses its ability to elastically deform as RCS pressure increases.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P697 (B1500)

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

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

B. a metal exhibits more ductile tendencies.

C. the probability of brittle fracture increases.

D. no appreciable deformation occurs prior to failure.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.02 [2.4/2.5]
QID: P996 (B2299)

The nil-ductility transition temperature is that temperature...

A. below which vessel failure is imminent.

B. above which vessel failure is imminent.

C. below which the probability of brittle fracture significantly increases.

D. above which the probability of brittle fracture significantly increases.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P96 (B100)

The likelihood of brittle fracture failure of the reactor vessel is reduced by...

A. increasing vessel age.

B. reducing vessel pressure.

C. reducing vessel temperature.

D. reducing gamma flux exposure.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P142

Operating with which of the following conditions is least effective in preventing brittle fracture in the reactor coolant system (RCS)?

A. Operating within prescribed heatup and cooldown rate limitations.

B. Operating with RCS temperature greater than nil-ductility transition temperature.

C. Operating with RCS pressure low when RCS temperature is low.

D. Operating with a ramped RCS temperature as power level varies.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P297

Why are reactor coolant system cooldown rate limitations established?

A. Prevent excessive reactivity additions.

B. Prevent brittle fracture of the reactor vessel.

C. Prevent excessive reactor coolant system subcooling.

D. Prevent impurities from precipitating out of solution in the reactor vessel.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P300

The thermal stress experienced by the reactor vessel during a reactor coolant system heatup is...

A. compressive at the inner wall and tensile at the outer wall of the vessel.

B. tensile at the inner wall and compressive at the outer wall of the vessel.

C. tensile across the entire vessel wall.

D. compressive across the entire vessel wall.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P398 (B400)

The probability of reactor vessel brittle fracture is <u>decreased</u> by minimizing...

A. oxygen content in the reactor coolant.

B. operation at high temperatures.

C. the time taken to cool down the reactor coolant system.

D. the amount of copper manufactured into the reactor vessel.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P399 (B399)

The total stress on the reactor vessel inner wall is greater during cooldown than heatup because...

A. heatup stress totally offsets pressure stress at the inner wall.

B. both pressure stress and cooldown stress are tensile at the inner wall.

C. cooldown stress and heatup stress are both tensile at the inner wall, but cooldown stress is greater in magnitude.

D. the tensile cooldown stress at the inner wall is greater in magnitude than the compressive pressure stress at the same location.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P898

The likelihood of brittle fracture failure of the reactor vessel is reduced by...

A. increasing vessel age.

B. reducing reactor vessel pressure.

C. reducing reactor vessel temperature.

D. increasing gamma flux exposure.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1098

Which one of the following will increase the compressive stress on the outside surface of the reactor vessel wall?

A. Neutron irradiation

B. Gamma irradiation

C. Reactor coolant system cooldown

D. Reactor coolant system heatup

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1298

Which one of the following applies a compressive stress to the inner wall of the reactor pressure vessel during a reactor coolant system heatup?

A. Embrittlement stress

B. Yield stress

C. Pressure stress

D. Thermal stress

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1397

Which one of the following is the most limiting component for establishing reactor coolant system heatup/cooldown rate limits?

A. Pressurizer

B. Reactor vessel

C. Fuel rod

D. Steam generator

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1598

Which one of the following stresses is compressive on the outer wall of the reactor pressure vessel during a reactor coolant system cooldown?

A. Yield stress

B. Thermal stress

C. Pressure stress

D. Embrittlement stress

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P1897 (B300)

Which one of the following will apply a compressive stress to the outside wall of the reactor vessel?

A. Decreasing reactor coolant system (RCS) pressure

B. Increasing RCS pressure

C. Performing an RCS cooldown

D. Performing an RCS heatup

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P2397 (B2399)

Reactor coolant system pressure-temperature limit curves are derived by using a conservative value for the reactor vessel reference temperature for nil ductility transition (RT_{NDT}).

Early in core life, the assumed value of RT_{NDT} is ___________ than actual RT_{NDT}; and actual RT_{NDT} is verified periodically over core life by _______________.

A. higher; removing and testing irradiated specimens of reactor vessel material

B. higher; inservice inspection and analysis of the reactor vessel wall

C. lower; removing and testing irradiated specimens of reactor vessel material

D. lower; inservice inspection and analysis of the reactor vessel wall

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P2998

Which one of the following operating limitations is designed to prevent brittle fracture of the reactor vessel?

A. Maximum setpoint for the pressurizer safety valves

B. Maximum differential pressure between the RCS and the steam generators

C. Maximum RCS pressure vs. RCS temperature for a given RCS heatup rate

D. Maximum differential temperature between the RCS and the pressurizer

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.04 [3.3/3.7]
QID: P3698 (B3700)

A nuclear reactor is shutdown with the shutdown cooling system maintaining reactor coolant temperature at 240°F immediately following an uncontrolled cooldown from 500°F. If reactor coolant temperature is held constant at 240°F, which one of the following describes the change in tensile stress on the inner wall of the reactor vessel (RV) over the next few hours?

A. Decreases, because the temperature gradient across the RV wall will decrease.

B. Increases, because the temperature gradient across the RV wall will decrease.

C. Decreases, because the inner RV wall temperature will approach the nil-ductility transition temperature.

D. Increases, because the inner RV wall temperature will approach the nil-ductility transition temperature.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P95

Fast neutron irradiation of the reactor vessel results in ________ stresses within the vessel metal, thereby _________ the nil-ductility transition temperature.

A. decreased; increasing

B. decreased; decreasing

C. increased; increasing

D. increased; decreasing

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P143

Fast neutron irradiation adversely affects the reactor pressure vessel primarily by causing...

A. metal embrittlement.

B. brittle fracture.

C. flaw initiation.

D. flaw propagation.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P298 (B599)

Prolonged exposure of the reactor vessel to a fast neutron flux will cause the reference temperature for nil-ductility transition (RT_{NDT}) to...

A. increase due to the propagation of existing flaws.

B. decrease due to the propagation of existing flaws.

C. increase due to changes in the material properties of the vessel wall.

D. decrease due to changes in the material properties of the vessel wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P499 (B500)

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

A. Beta

B. Thermal neutrons

C. Gamma

D. Fast neutrons

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P899 (B1900)

After several years of operation the maximum allowable stress to the reactor pressure vessel is more limited by the inner wall than the outer wall because...

A. the inner wall operates at a higher temperature than the outer wall.

B. the inner wall has a smaller surface area than the outer wall.

C. the inner wall experiences more neutron-induced embrittlement than the outer wall.

D. the inner wall experiences more tensile stress than the outer wall.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P998 (B1999)

Prolonged exposure to __________ will cause nil-ductility transition temperature of the reactor vessel to __________.

A. neutron radiation; increase

B. neutron radiation; decrease

C. boric acid; increase

D. boric acid; decrease

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1100 (B1100)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 40 heatup/cooldown cycles with an average power capacity of 50%. Reactor B has experienced 30 heatup/cooldown cycles with an average power capacity of 60%.

Which reactor will have the lowest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the lower average power capacity.

B. Reactor A due to the greater number of heatup/cooldown cycles.

C. Reactor B due to the higher average power capacity.

D. Reactor B due to the fewer number of heatup/cooldown cycles.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1498

The two factors that have the greatest effect on the reference temperature for nil-ductility transition (RT_{NDT}) of the reactor vessel over its life are...

A. thermal neutron flux and vessel copper content.

B. thermal neutron flux and vessel carbon content.

C. fast neutron flux and vessel copper content.

D. fast neutron flux and vessel carbon content.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1699 (B1800)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles and has an average power capacity of 60%. Reactor B has experienced 40 heatup/cooldown cycles and has an average power capacity of 50%.

Which reactor will have the lowest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the fewer number of heatup/cooldown cycles

B. Reactor A due to the higher average power capacity

C. Reactor B due to the greater number of heatup/cooldown cycles

D. Reactor B due to the lower average power capacity

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1898 (B1200)

Which one of the following is the major contributor to embrittlement of the reactor vessel?

A. High-energy fission fragments

B. High operating temperature

C. High-energy gamma radiation

D. High-energy neutron radiation

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P1997 (B299)

Which one of the following describes the effect of fast neutron irradiation on a reactor pressure vessel?

A. Increased fatigue crack growth rate

B. Increased plastic deformation prior to failure

C. Increased metal toughness

D. Increased nil-ductility reference transition temperature

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2098 (B2100)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles and has an average power capacity of 60%. Reactor B has experienced 40 heatup/cooldown cycles and has an average power capacity of 50%.

Which reactor will have the highest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the fewer number of heatup/cooldown cycles

B. Reactor A due to the higher average power capacity

C. Reactor B due to the greater number of heatup/cooldown cycles

D. Reactor B due to the lower average power capacity

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2298

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 40 heatup/cooldown cycles and has an average power capacity of 50%. Reactor B has experienced 30 heatup/cooldown cycles and has an average power capacity of 60%.

Which reactor will have the highest reactor vessel nil-ductility transition temperature?

A. Reactor A due to the greater number of heatup/cooldown cycles

B. Reactor A due to the lower average power capacity

C. Reactor B due to the fewer number of heatup/cooldown cycles

D. Reactor B due to the higher average power capacity

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2599 (B2600)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 60% and has been operating for 15 years. Reactor B has an average lifetime power capacity of 75% and has been operating for 12 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

A. Reactor A due to the lower average lifetime power capacity.

B. Reactor B due to the higher average lifetime power capacity.

C. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same number of fissions.

D. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2698 (B3000)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 60% and has been operating for 15 years. Reactor B has an average lifetime power capacity of 60% and has been operating for 12 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced the greater number of fissions.

B. Reactor B because it has produced the fewer number of fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because they have equal average lifetime power capacities.

D. Both reactors will have approximately the same nil ductility transition temperature because the fission rate in a shut down core is not significant.

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P2799 (B2800)

Two identical nuclear reactors have been in operation for the last 10 years. Reactor A has experienced 30 heatup/cooldown cycles and has an average power capacity of 60%. Reactor B has experienced 20 heatup/cooldown cycles and has an average power capacity of 80%.

Which reactor will have the highest reactor vessel nil-ductility transition temperature and why?

A. Reactor A due to the greater number of heatup/cooldown cycles

B. Reactor A due to the lower average power capacity

C. Reactor B due to the fewer number of heatup/cooldown cycles

D. Reactor B due to the higher average power capacity

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3197 (B3200)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85%. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing determines that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 42°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is <u>more</u> likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is <u>less</u> likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the specimen NDT temperature would <u>not</u> decrease during the described 18-month period of operation.

D. The test results are questionable because the specimen NDT temperature would decrease by <u>more</u> than 2°F during the described 18-month period of operation.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3297 (B3300)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85%. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing determines that the nil-ductility transition (NDT) temperature of the specimen has increased from 42°F to 44°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is more susceptible to brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is less susceptible to brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the vessel NDT temperature would not increase during the described 18-month period of operation.

D. The test results are questionable because the vessel NDT temperature would increase by at least 10°F during the described 18-month period of operation.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3598 (B3600)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85%. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The testing indicates that the nil-ductility transition (NDT) temperature of the specimen has decreased from 44°F to 32°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is more likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is less likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the actual specimen NDT temperature would not decrease during the described 18-month period of operation.

D. The test results are questionable because the actual specimen NDT temperature would decrease by much less than indicated by the test results.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P3898 (B3900)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 90% and has been operating for 10 years. Reactor B has an average lifetime power capacity of 80% and has been operating for 15 years.

Which reactor will have the higher reactor vessel nil ductility transition temperature and why?

A. Reactor A because it has the higher average lifetime power capacity.

B. Reactor B because it has the lower average lifetime power capacity.

C. Reactor A because it has produced significantly less fissions.

D. Reactor B because it has produced significantly more fissions.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P4250 (B4250)

A nuclear reactor is shut down for refueling following 18 months of operation at an average power level of 85%. During the shutdown, a reactor vessel metal specimen was removed from the reactor vessel for testing. The tests determined that the nil-ductility transition (NDT) temperature of the specimen has increased from 42°F to 72°F since the previous refueling shutdown.

Which one of the following conclusions is warranted?

A. The test results are credible and the reactor vessel is more likely to experience brittle fracture now than after the previous refueling shutdown.

B. The test results are credible and the reactor vessel is less likely to experience brittle fracture now than after the previous refueling shutdown.

C. The test results are questionable because the specimen NDT temperature would not increase during the described 18-month period of operation.

D. The test results are questionable because the specimen NDT temperature would increase by less than indicated during the described 18-month period of operation.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P4450 (B4450)

A nuclear reactor is shut down for refueling. During the shutdown, a reactor vessel metal specimen is removed from the reactor vessel for testing. The specimen was last tested six years ago. During the subsequent six years, the reactor has completed several 18-month fuel cycles with an average power level of 85%.

The test determines that the nil-ductility transition (NDT) temperature of the specimen has remained unchanged at 44°F since it was last tested. Which one of the following conclusions is warranted?

A. The test results are credible, however, the reactor vessel is more susceptible to brittle fracture now than six years ago.

B. The test results are credible, however, the reactor vessel is less susceptible to brittle fracture now than six years ago.

C. The test results are questionable because the specimen NDT temperature should have increased since it was last tested.

D. The test results are questionable because the specimen NDT temperature should have decreased since it was last tested.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P4650 (B4650)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has achieved an average lifetime power capacity of 60% while operating for 12 years. Reactor B has achieved an average lifetime power capacity of 60% while operating for 15 years.

Which reactor, if any, will have the lower reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced the fewer total number of fissions.

B. Reactor B because it has produced the greater total number of fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because they have equal average lifetime power capacities.

D. Both reactors will have approximately the same nil ductility transition temperature because the fission rate in a shut down core is not significant.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.06 [3.6/3.8]
QID: P99

A nuclear power plant is shut down with the reactor coolant system at 1,200 psia and 350°F. Which one of the following would be most likely to cause pressurized thermal shock of the reactor vessel?

A. A rapid depressurization followed by a rapid heatup

B. A rapid depressurization followed by a rapid cooldown

C. A rapid cooldown followed by a rapid pressurization

D. A rapid heatup followed by a rapid pressurization

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.05 [2.9/3.0]
QID: P5550 (B5550)

Two identical nuclear reactors are currently shut down for refueling. Reactor A has an average lifetime power capacity of 90% and has been operating for 24 years. Reactor B has an average lifetime power capacity of 72% and has been operating for 30 years.

Which reactor, if any, will have the lowest reactor vessel nil ductility transition temperature?

A. Reactor A because it has produced the greater total number of fissions.

B. Reactor B because it has produced the fewer total number of fissions.

C. Both reactors will have approximately the same nil ductility transition temperature because fast neutron irradiation in a shut down core is not significant.

D. Both reactors will have approximately the same nil ductility transition temperature because each core has produced approximately the same total number of fissions.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.06 [3.6/3.8]
QID: P299

Pressurized thermal shock is a condition that can occur following a rapid __________ of the reactor coolant system (RCS) if RCS pressure is rapidly ____________.

A. cooldown; decreased

B. cooldown; increased

C. heatup; decreased

D. heatup; increased

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.06 [3.6/3.8]
QID: P2800

Which one of the following would be most likely to cause pressurized thermal shock of a reactor vessel?

A. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature less than RCS loop temperature.

B. Starting a reactor coolant pump in an idle loop with the associated steam generator temperature greater than RCS loop temperature.

C. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a steam generator steam outlet nozzle.

D. Continuous emergency coolant injection to the RCS during and after a complete and unisolable rupture of a reactor vessel coolant outlet nozzle.

ANSWER: C.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P100

During a severe overcooling transient, a major concern to the operator is...

A. accelerated zirconium hydriding.

B. loss of reactor vessel water level.

C. loss of reactor coolant pump net positive suction head.

D. brittle fracture of the reactor vessel.

ANSWER: D.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1000

An uncontrolled cooldown is a brittle fracture concern because it creates a large __________ stress at the __________ wall of the reactor vessel.

A. tensile; inner

B. tensile; outer

C. compressive; inner

D. compressive; outer

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1099

During an uncontrolled cooldown of a reactor coolant system, the component most susceptible to pressurized thermal shock is the...

A. reactor vessel.

B. steam generator tube sheet.

C. cold leg accumulator penetration.

D. loop resistance temperature detector penetration.

ANSWER: A.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1199

Which one of the following describes the thermal stress placed on the reactor vessel during a cooldown of the reactor coolant system?

A. Compressive at the inner wall, tensile at the outer wall

B. Tensile at the inner wall, compressive at the outer wall

C. Compressive across the entire wall

D. Tensile across the entire wall

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P1500

The thermal stress experienced by the reactor vessel during a reactor coolant system cooldown is...

A. tensile across the entire vessel wall.

B. tensile at the inner wall, compressive at the outer wall of the vessel.

C. compressive across the entire vessel wall.

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

ANSWER: B.

TOPIC: 193010
KNOWLEDGE: K1.07 [3.8/4.1]
QID: P2797

A nuclear power plant heatup is in progress using reactor coolant pumps. The heatup stress applied to the reactor vessel is...

A. tensile across the entire wall.

B. tensile at the inner wall and compressive at the outer wall.

C. compressive across the entire wall.

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

ANSWER: D.