科目： 193008
知能類：K1.01 [2.8/3.0]
序號： P986

Which one of the following is an example of radiative heat transfer?

A. Heat transfer from the fuel cladding to the reactor coolant during stable film boiling

B. Heat transfer from the center to the edge of a fuel pellet at end of core life

C. Heat transfer from the reactor coolant to the feedwater in a steam generator

D. Heat transfer from the fuel cladding to the reactor coolant via subcooled nucleate boiling

ANSWER: A.

下列何者為輻射傳熱的例子？

A. 於穩定薄膜沸騰期間，從燃料護套傳熱至反應器冷卻水。

B. 於爐心壽命末期，從燃料丸中央傳熱至邊緣。

C. 從反應器冷卻水傳熱至蒸汽產生器的飼水。

D. 從燃料護套經由次冷核沸騰，傳熱至反應器冷卻水。

答案：A.

科目： 193008
知能類：K1.01 [2.8/3.0]
序號： P1186 (B1986)

Refer to the drawing of a pool boiling curve (see figure below).

Identify the region of the curve where the most efficient form of heat transfer exists.

A. Region I

B. Region II

C. Region III

D. Region IV

ANSWER: B.

請參照下圖的池式沸騰曲線。

熱傳最有效率的曲線區域是？

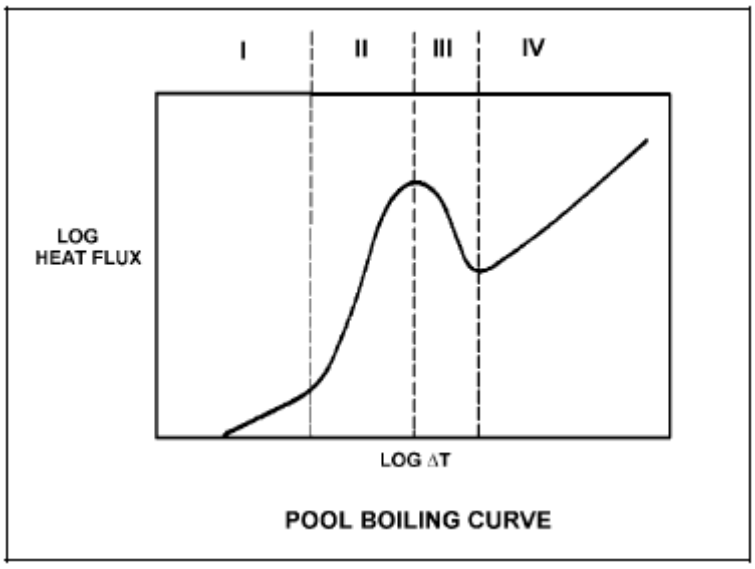
A. I 區

B. II 區

C. III 區

D. IV 區

答案：B.



科目： 193008
知能類：K1.01 [2.8/3.0]
序號： P1286 (B2088)

Refer to the drawing of a pool boiling curve (see figure below).

Which region of the curve contains the operating point at which the hottest locations of the nuclear reactor operate to transfer heat from the cladding to the coolant at 100% power?

A. Region I

B. Region II

C. Region III

D. Region IV

ANSWER: B.

請參照下圖的池式沸騰曲線。

在100%功率下，對核子反應器的最熱位置而言，由護套傳熱到冷卻水的運轉點在那個曲線區域？

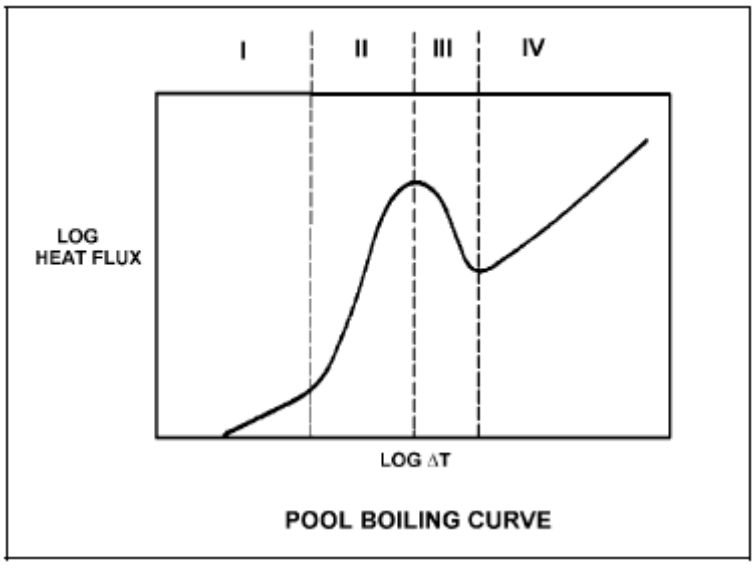
A. I 區

B. II 區

C. III 區

D. IV 區

答案：B.



科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P85

Why does nucleate boiling improve heat transfer in a nuclear reactor core?

A. The formation of steam bubbles at nucleation sites on the fuel clad allows more heat to be transferred by conduction.

B. The formation of steam bubbles at nucleation sites on the fuel clad promotes local radiative heat transfer and allows more heat to be transferred by convection.

C. Heat is removed from the fuel rod as both sensible heat and latent heat of condensation, and the heat is transferred directly to the coolant by radiative heat transfer.

D. Heat is removed from the fuel rod as both sensible heat and latent heat of vaporization, and the motion of the steam bubbles causes rapid mixing of the coolant.

ANSWER: D.

核沸騰為什麼能改善核子反應器爐心的傳熱？

A. 在燃料護套成核位置形成的汽泡，可透過傳導形式傳送更多熱。

B. 在燃料護套成核位置形成的汽泡促使局部輻射傳熱，並允許以對流方式傳送更多熱。

C. 熱以顯熱(sensible heat)及冷凝潛熱兩方式移出燃料棒，熱量再透過輻射熱傳直接傳送至冷卻水。

D. 燃料棒基於顯熱(sensible heat)及潛熱蒸發而排熱，汽泡移動造成冷卻水迅速混合。

答案：D.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P886

Convection heat transfer improves when nucleate boiling begins on the surface of a fuel rod because:

A. steam bubble formation decreases coolant flow along the fuel rod.

B. steam bubble formation increases coolant flow along the fuel rod.

C. a steam blanket begins to form along the surface of the fuel rod.

D. the motion of the steam bubbles causes rapid mixing of the coolant.

ANSWER: D.

燃料棒表面開始核沸騰時，能改善對流傳熱，這是因為：

A. 汽泡形成而減少沿著燃料棒流動的冷卻水。

B. 汽泡形成而增加沿著燃料棒流動的冷卻水。

C. 蒸汽膜(steam blanket)開始沿著燃料棒表面形成。

D. 汽泡移動而導致冷卻水迅速混合。

答案：D.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P1086 (B2784)

How does the convective heat transfer coefficient vary from the bottom to the top of a fuel rod if subcooled reactor coolant enters the coolant channel and exits as superheated steam?

A. Increases continuously

B. Increases, then decreases

C. Decreases continuously

D. Decreases, then increases

ANSWER: B.

如果次冷反應器冷卻水進入冷卻水通道，並以過熱蒸汽(superheated steam)離開，則燃料棒從底部到頂部之對流熱傳係數的變化狀況為何？

A. 連續增加。

B. 先增加再減少。

C. 連續減少。

D. 先減少再增加。

答案：B.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P1187

Nucleate boiling affects heat transfer from a fuel rod primarily by...

A. increasing the conductive heat transfer from the fuel rod to the coolant.

B. increasing the convective heat transfer from the fuel rod to the coolant.

C. decreasing the conductive heat transfer from the fuel rod to the coolant.

D. decreasing the convective heat transfer from the fuel rod to the coolant.

ANSWER: B.

核沸騰主要以哪種方式影響燃料棒的傳熱？

A. 增加從燃料棒至冷卻水的傳導傳熱。

B. 增加從燃料棒至冷卻水的對流傳熱。

C. 減少從燃料棒至冷卻水的傳導傳熱。

D. 減少從燃料棒至冷卻水的對流傳熱。

答案：B.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P2386

Subcooled water enters the bottom of an operating nuclear reactor core that is experiencing a significant overpower transient. As the water flows upward past the fuel assembies, boiling occurs at the surface of a few fuel assemblies.

If the coolant had remained subcooled, average fuel temperature would have been _____ because single-phase convection is a _____ efficient method of heat transfer than boiling.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

ANSWER: B.

次冷水進入運轉中核子反應器的爐心底部時，爐心正發生顯著的過功率暫態。隨著水流往上流過燃料元件，少數燃料元件表面發生沸騰。

如果冷卻水維持次冷，燃料平均溫度則_____，因為相較於沸騰，單相熱對流為_____效率的熱傳方法。

A. 較高；較有

B. 較高；較無

C. 較低；較有

D. 較低；較無

答案：B.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P2686 (B2486)

Case 1: Pure subcooled reactor coolant is flowing through a fuel assembly in a reactor core operating at steady-state full power. As the coolant flows upward past the fuel assembly, the water heats up and exits the fuel assembly still subcooled.

Case 2: Same as above except that reactor coolant system pressure is decreased such that coolant begins to boil halfway up the fuel assembly, which results in a saturated steam-water mixture exiting the fuel assembly.

Assume departure from nucleate boiling is avoided in both cases and that both cores continue to operate at full power. As compared to Case 1, the average fuel temperature for Case 2 will be _____ because boiling is a _____ efficient method of heat transfer.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

ANSWER: C.

情況1：純次冷反應器冷卻水進入以穩態全功率運轉的反應器爐心燃料元件。當冷卻水流向上通過燃料元件，水被加熱並離開燃料元件後，仍處於次冷狀態。

情況2：同上，但是反應器冷卻水系統壓力降低，讓冷卻水於往上流過燃料元件的途中開始沸騰，導致以飽和蒸汽-水混合物離開燃料元件。

假設上述兩種情況都規避偏離核沸騰的情形，而且兩個爐心均繼續以全功率運轉。相較於情況1，情況2的平均燃料溫度將_____，因為沸騰乃是_____效率之熱傳方式。

A. 較高；較有

B. 較高；較無

C. 較低；較有

D. 較低；較無

答案：C.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P2986 (B2986)

Subcooled reactor coolant flows into the bottom of a fuel assembly coolant channel and exits the top of the channel as a saturated steam-water mixture with a 98% moisture content. How does the overall heat transfer coefficient in the coolant channel change as the coolant travels upward along the channel?

A. Increases only

B. Increases, then decreases

C. Decreases only

D. Decreases, then increases

ANSWER: A.

如果次冷反應器冷卻水流入燃料元件冷卻水通道的底部，並在通道頂部以含水量98%的飽和蒸汽-水混合物方式離開。則當冷卻水在通道中向上流動時，冷卻水通道的整體熱傳係數變化為何？

A. 只會增加。

B. 先增加再減少。

C. 只會減少。

D. 先減少再增加。

答案：A.

科目： 193008
知能類：K1.02 [2.8/3.0]
序號： P3786 (B3785)

Subcooled water is flowing into a fuel assembly in an operating nuclear reactor core. As the water flows upward through the fuel assembly, some of the water in contact with the fuel rods begins to boil.

If fuel assembly power is unchanged and system pressure is increased such that all of the water remains subcooled, the average fuel temperature in the fuel assembly would be _____ because boiling is a _____ efficient method of heat transfer.

A. higher; more

B. higher; less

C. lower; more

D. lower; less

ANSWER: A.

次冷水流入一運轉中反應器爐心的燃料元件。當水流向上通過燃料元件，部分接觸燃料棒的水開始沸騰。

若燃料元件功率不變，同時系統壓力增加，使得所有的水仍維持次冷，則燃料元件的平均燃料溫度將會_____，因為沸騰乃是_____效率之熱傳方式。

A. 較高；較有

B. 較高；較無

C. 較低；較有

D. 較低；較無

答案：A.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P86

Subcooled nucleate boiling is occurring along a heated surface. The heat flux is then increased slightly. What will be the effect on the ΔT between the surface and the fluid? (Assume subcooled nucleate boiling is still occurring.)

A. Large increase in ΔT because of steam blanketing

B. Large increase in ΔT causing radiative heat transfer to become significant

C. Small increase in ΔT because of steam blanketing

D. Small increase in ΔT as vapor bubbles form and collapse

ANSWER: D.

次冷核沸騰沿著加熱表面發生，熱通量之後微增。此情況對表面與流體之間的 ΔT 有何影響？(假設仍發生次冷核沸騰)

A. 蒸汽膜(steam blanket)造成 ΔT 大增。

B. ΔT 大增導致輻射傳熱變得顯著。

C. 蒸汽膜(steam blanket)造成 ΔT 小幅增加。

D. ΔT 隨著汽泡形成並凝結消失(collapse)而小幅增加。

答案：D.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P286 (B389)

As heat is transferred to water adjacent to a heating surface, many factors influence steam bubble formation. Which one of the following characteristics will enhance steam bubble formation?

A. Chemicals dissolved in the water

B. The absence of ionizing radiation exposure to the water

C. A highly polished heat transfer surface with minimal scratches or cavities

D. The presence of gases dissolved in the water

ANSWER: D.

當一熱表面之熱傳至周圍之水，許多因素會影響汽泡形成。下列何者將增加汽泡形成？

A. 溶解水中之化學物質。

B. 水缺乏游離輻射暴露。

C. 具有最少刮痕與孔洞的高度光滑熱傳表面。

D. 溶解水中的氣體。

答案：D.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P387 (B388)

What type of boiling is described as follows: The bulk temperature of the liquid is below saturation, but the temperature of the heat transfer surface is above saturation. Vapor bubbles form at the heat transfer surface, but condense in the cold liquid so that no net generation of vapor is obtained.

A. Bulk boiling

B. Subcooled nucleate boiling

C. Total film boiling

D. Partial film boiling

ANSWER: B.

下列描述的是何種沸騰？液體的整體溫度在飽和以下，但是熱傳表面溫度則在飽和之上。汽泡在熱傳表面形成，但是在冷液體中冷凝，因此並無蒸汽淨生成。

A. 整體沸騰。

B. 次冷核沸騰。

C. 整體薄膜沸騰。

D. 部分薄膜沸騰(Partial film boiling)。

答案：B.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P1686 (B1087)

Which one of the following is a characteristic of subcooled nucleate boiling but not saturated nucleate boiling?

A. T_{Clad} equals T_{Sat}

B. T_{Clad} is greater than T_{Sat}

C. $T_{Bulk\ Coolant}$ equals T_{Sat}

D. $T_{Bulk\ Coolant}$ is less than T_{Sat}

ANSWER: D.

下列何者是次冷核沸騰的特徵，而非飽和核沸騰的特徵？

A. T_{Clad}等於T_{sat}

B. T_{Clad}大於T_{sat}

C. $T_{Bulk\ Coolant}$等於T_{sat}

D. $T_{Bulk\ Coolant}$小於T_{Sat}

答案：D.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P1888 (B1786)

Which one of the following is a characteristic of saturated nucleate boiling but not subcooled nucleate boiling?

A. $T_{Bulk\ Coolant}$ equals T_{Sat}

B. $T_{Bulk\ Coolant}$ is less than T_{Sat}

C. T_{Clad} equals T_{Sat}

D. T_{Clad} is greater than T_{Sat}

ANSWER: A.

下列何者是飽和核沸騰的特徵，而非次冷核沸騰的特徵？

A. $T_{Bulk\ Coolant}$等於T_{sat}

B. $T_{Bulk\ Coolant}$小於T_{Sat}

C. T_{Clad}等於T_{sat}

D. T_{Clad}大於T_{sat}

答案：A.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P2287 (B1086)

Which one of the following describes why the core heat transfer rate increases when nucleate boiling begins on the surface of a fuel rod?

A. Steam has a greater thermal conductivity than water.

B. The formation of steam bubbles increases coolant flow rate along the fuel rod.

C. Radiative heat transfer begins to supplement convective heat transfer.

D. Heat transfer by steam bubble formation is more effective than through a liquid film.

ANSWER: D.

當核沸騰開始在燃料棒表面發生時，下列何者為爐心熱傳速率增加之原因？

A. 蒸汽的熱傳係數大於水。

B. 汽泡形成導致沿著燃料棒的冷卻水流量增加。

C. 除了對流熱傳外，開始有輻射熱傳。

D. 利用汽泡形成以進行熱傳的方式，較透過液體薄膜熱傳更有效率。

答案：D.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P2687 (B1287)

Which one of the following modes of heat transfer is characterized by steam bubbles moving away from a heated surface and collapsing in the bulk fluid?

A. Bulk boiling

B. Subcooled nucleate boiling

C. Saturated nucleate boiling

D. Saturated natural convection

ANSWER: B.

下列何種熱傳特徵是汽泡從加熱表面離開，而在整體水流中凝結消失(collapsing)？

A. 整體沸騰

B. 次冷核沸騰

C. 飽和核沸騰

D. 飽和自然對流

答案：B.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P2787 (B1285)

A nuclear reactor is operating at 100% power. Which one of the following will increase the likelihood of vapor bubble formation in the reactor coolant?

A. Surface scratches or cavities in the fuel clad

B. Subsurface void defect in the fuel clad

C. Increased coolant velocity past the fuel rods

D. Chemically inert material dissolved in the coolant

ANSWER: A.

一部核子反應器以100%功率運轉。下列何者將增加反應器冷卻水形成汽泡的可能性？

A. 燃料護套表面的刮痕或孔洞。

B. 燃料護套的次表面空泡缺陷(subsurface void defect)。

C. 增加通過燃料棒的冷卻水流速。

D. 溶解於冷卻水中的惰性化學物質。

答案：A.

科目： 193008
知能類：K1.03 [2.8/3.1]
序號： P3686 (B3685)

A nuclear reactor is currently shutdown after several months of operation at full power. The shutdown cooling system is in operation, maintaining an average reactor coolant temperature of 280°F. A pressure control malfunction causes RCS pressure to slowly and continuously decrease from 100 psia while reactor coolant temperature remains constant. (Assume a normal reactor coolant flow direction through the core.)

Which one of the following describes where nucleate boiling will first occur?

A. At a scratch on the surface of a fuel rod near the top of a fuel assembly.

B. At a scratch on the surface of a fuel rod near the bottom of a fuel assembly.

C. In the bulk fluid of a coolant channel near the top of a fuel assembly.

D. In the bulk fluid of a coolant channel near the bottom of a fuel assembly.

ANSWER: A.

一部核子反應器經過數月的全功率運轉後，目前停機。停機冷卻系統正在運轉中，反應器冷卻水平均溫度維持在280°F。因壓力控制故障導致在反應器冷卻水溫度維持不變下，RCS的壓力從100 psia持續緩慢降低。(假設正常反應器冷卻水的流動方向為通過爐心)

下列何者描述了最先發生核沸騰之處？

A. 在靠近燃料元件頂部之燃料棒的表面刮痕上。

B. 在靠近燃料元件底部之燃料棒的表面刮痕上。

C. 在靠近燃料元件頂部之冷卻水通道的整體流(bulk fluid)中。

D. 在靠近燃料元件底部之冷卻水通道的整體流中。

答案：A.

科目： 193008
知能類：K1.04 [3.1/3.3]
序號： P287 (B2987)

If ΔT is the temperature difference between the fuel rod clad surface and the coolant, which one of the following describes the heat transfer from a fuel rod experiencing departure from nucleate boiling?

A. Steam bubbles begin to blanket the fuel rod clad, causing a rapid increase in the ΔT for a given heat flux.

B. Steam bubbles completely blanket the fuel rod clad, causing a rapid decrease in the ΔT for a given heat flux.

C. Steam bubbles begin to form on the fuel rod clad, causing a rapid decrease in the heat flux from the fuel rod for a given ΔT.

D. Steam bubbles completely blanket the fuel rod clad, causing a rapid increase in the heat flux from the fuel rod for a given ΔT.

ANSWER: A.

若燃料棒護套表面與冷卻水之間的溫差為ΔT，下列何者描述了燃料棒在偏離核沸騰時的熱傳？

A. 汽泡開始覆蓋燃料棒護套，導致ΔT快速增加(當熱通量固定時)。

B. 汽泡完全覆蓋燃料棒護套，導致ΔT快速減小(當熱通量固定時)。

C. 汽泡開始在燃料棒護套上形成，導致燃料棒的熱通率快速減小(當ΔT固定時)。

D. 汽泡完全覆蓋燃料棒護套，導致燃料棒的熱通率快速增加(當ΔT固定時)。

答案：A.

科目： 193008
知能類：K1.04 [3.1/3.3]
序號： P93

If departure from nucleate boiling is reached in the core, the surface temperature of the fuel clad will...

A. increase rapidly.

B. decrease rapidly.

C. increase gradually.

D. decrease gradually.

ANSWER: A.

如果爐心發生偏離核沸騰，燃料護套的表面溫度將……

A. 迅速升高。

B. 迅速降低。

C. 逐漸升高。

D. 逐漸降低。

答案：A.

科目： 193008
知能類：K1.04 [3.1/3.3]
序號： P1288 (B1985)

Departure from nucleate boiling should not be allowed to occur in the core because the...

A. steam bubbles begin to blanket the clad and decrease radiative heat transfer.

B. steam bubbles in the coolant may cause flow oscillations.

C. rapid increase in ΔT between the clad and the coolant may cause clad damage.

D. associated addition of reactivity from the void coefficient could be uncontrollable.

ANSWER: C.

爐心不得發生偏離核沸騰(DNB)，因為……

A. 汽泡開始覆蓋護套，輻射熱傳會減少。

B. 冷卻水內的汽泡可能造成水流振盪。

C. 護套與冷卻水之間的ΔT迅速增加，可能導致護套受損。

D. 可能無法控制空泡係數加入的相關反應度。

答案：C.

科目： 193008
知能類：K1.04 [3.1/3.3]
序號： P3388 (B1288)

Which one of the following is indicated by a rapid increase in the fuel clad-to-coolant ΔT and a decrease in heat flux from the fuel?

A. Bulk boiling is occurring.

B. Nucleate boiling is occurring.

C. Critical heat flux is increasing.

D. Departure from nucleate boiling has been reached.

ANSWER: D.

燃料護套與冷卻水間溫差(ΔT)的快速增加與來自燃料的熱通率減少，代表了下列何者？

A. 正發生整體沸騰。

B. 正發生核沸騰。

C. 臨界熱通率正在增加。

D. 已達到偏離核沸騰(DNB)。

答案：D.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P138

Which one of the following reactor coolant system parameters has the least effect on margin to departure from nucleate boiling?

A. Pressurizer level

B. Local power density

C. Cold leg temperature

D. Coolant flow rate

ANSWER: A.

下列那項反應器冷卻水系統參數，對偏離核沸騰餘裕的影響最小？

A. 調壓槽水位。

B. 局部功率密度。

C. 冷端溫度。

D. 冷卻水流率。

答案：A.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P144

An adequate subcooling margin during a loss of coolant accident is the most direct indication that _____ is being maintained.

A. steam generator water level

B. pressure level

C. core cooling

D. subcriticality

ANSWER: C.

發生冷卻水流失事故時，一足夠的次冷餘裕最能直接指出_____正被維持著。

A. 蒸汽產生器水位

B. 壓力

C. 爐心冷卻

D. 次臨界

答案：C.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P288

Which one of the following parameter changes will reduce the departure from nucleate boiling ratio?

A. Decrease in reactor power

B. Increase in pressurizer pressure

C. Increase in reactor coolant flow

D. Increase in reactor coolant temperature

ANSWER: D.

下列那項參數變化將降低偏離核沸騰比？

A. 反應器功率降低。

B. 調壓槽壓力增加。

C. 反應器冷卻水流增加。

D. 反應器冷卻水溫升高。

答案：D.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P489

Which one of the following incidents will cause the departure from nucleate boiling ratio to increase? (Assume the reactor does not trip.)

A. A reactor coolant pump trips at 20% reactor power.

B. A rod drops at 100% reactor power with manual rod control.

C. One steam dump valve fails open at 50% reactor power.

D. All pressurizer heaters energize fully at 40% reactor power.

ANSWER: D.

下列哪項事故將導致偏離核沸騰比增加？(假設反應器沒有急停)

A. 冷卻水泵於反應器功率 20%時跳脫。

B. 反應器功率為 100%控制棒手動控制時一控制棒掉落。

C. 反應器功率為 50%時，一蒸汽排放閥故障打開 (fail open)。

D. 所有調壓槽加熱器於反應器功率 40%時全部賦能。

答案：D.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P1093

Which one of the following will increase the departure from nucleate boiling ratio?

A. Increasing reactor coolant temperature

B. Increasing pressurizer pressure

C. Increasing core bypass flow

D. Increasing reactor power

ANSWER: B.

下列何者將增加偏離核沸騰比？

A. 反應器冷卻水溫升高。

B. 調壓槽壓力增加。

C. 爐心旁通水流增加。

D. 反應器功率增加。

答案：B.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P1787

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Assuming reactor power level does not change, which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. One reactor coolant pump trips with automatic rod control.

B. A spray valve malfunction decreases reactor coolant system pressure by 20 psig with no rod motion.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

ANSWER: D.

核能電廠以下列初始條件運轉：

- 反應器為燃料週期中期，功率為 45%。
- 軸向與徑向功率分佈於爐心中央達到尖峰。

假設反應器功率不變，下列何者將增加穩態偏離核沸騰比？

A. 一反應器冷卻水泵跳脫，此時的控制棒為自動控制。

B. 噴灑閥(spray valve)功能異常造成反應器冷卻水系統壓力降低 20 psig，控制棒沒有移動。

C. 運轉員將反應器冷卻水硼濃度減少 5 ppm，控制棒沒有移動。

D. 爐心的 Xe-135 累積量與軸向及徑向功率分佈成正比，此時的控制棒為自動控制。

答案：D.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P1889

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction increases reactor coolant system pressure by 20 psig with no rod motion.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

ANSWER: C.

核能電廠以下列初始條件運轉：

- 反應器為燃料週期中期，功率為 45%。
- 軸向與徑向功率分佈於爐心中央達到尖峰。

下列何者將減少穩態偏離核沸騰比？

A. 反應器發生急停且一根控制棒仍維持在完全抽出爐心的位置。

B. 調壓槽功能異常造成反應器冷卻水系統壓力增加 20 psig，控制棒沒有移動。

C. 運轉員將反應器冷卻水硼濃度減少 5 ppm，控制棒沒有移動。

D. 爐心的 Xe-135 累積量與軸向及徑向功率分佈成正比，此時的控制棒為自動控制。

答案：C.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P2288

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 55% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction increases reactor coolant system pressure by 20 psig.

C. The operator increases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 depletes in proportion to the axial and radial power distribution with no rod motion.

ANSWER: D.

核能電廠以下列初始條件運轉：

- 反應器為燃料週期中期，功率為 55%。
- 軸向與徑向功率分佈於爐心中央達到尖峰。

下列何者將減少穩態偏離核沸騰比？

A. 反應器發生急停且一根控制棒仍維持在完全抽出爐心的位置。

B. 調壓槽功能異常造成反應器冷卻水系統壓力增加 20 psig。

C. 運轉員將反應器冷卻水硼濃度增加 5 ppm，控制棒沒有移動。

D. 爐心的 Xe-135 燃耗量與軸向及徑向功率分佈成正比，控制棒沒有移動。

答案：D.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P2387

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will decrease the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with no rod motion.

C. The operator increases reactor coolant boron concentration by 5 ppm with no control rod motion.

D. Core Xe-135 builds up in proportion to the axial and radial power distribution with automatic rod control.

ANSWER: B.

核能電廠以下列初始條件運轉：

- 反應器為燃料週期中期，功率為 45%。
- 軸向與徑向功率分佈於爐心中央達到尖峰。

下列何者將減少穩態偏離核沸騰比？

A. 反應器發生急停且一根控制棒仍維持在完全抽出爐心的位置。

B. 調壓槽功能異常造成反應器冷卻水系統壓力減少 20 psig，控制棒沒有移動。

C. 運轉員將反應器冷卻水硼濃度增加 5 ppm，控制棒沒有移動。

D. 爐心的 Xe-135 累積量與軸向及徑向功率分佈成正比，控制棒為自動控制。

答案：B.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P2487(B2487)

A nuclear reactor is shutdown at normal operating temperature and pressure with all control rods inserted. Which one of the following will decrease the departure from nucleate boiling ratio for this reactor? (Assume the reactor remains shutdown.)

A. Fully withdrawing a bank of shutdown rods

B. Diluting RCS boron concentration by 50 ppm

C. Reducing RCS flow rate by 1%

D. Increasing RCS pressure by 10 psig

ANSWER: C.

一部核子反應器在正常運轉溫度及壓力下停機，所有控制棒均插入。下列何者將降低該反應器的偏離核沸騰比？(假設反應器維持在停機狀況下)

A. 將一停機棒組完全抽出。

B. RCS硼濃度稀釋50 ppm。

C. 減少1%的RCS流量。

D. 增加RCS壓力10 psig。

答案：C.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P2587

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 55% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. A reactor trip occurs and one control rod remains fully withdrawn from the core.

B. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no rod motion.

D. Core Xe-135 depletes in proportion to the axial and radial power distribution with no rod motion.

ANSWER: A.

核能電廠以下列初始條件運轉：

- 反應器為燃料週期中期，功率為 55%。
- 軸向與徑向功率分佈於爐心中央達到尖峰。

下列何者將增加穩態偏離核沸騰比？

A. 反應器發生急停且一根控制棒仍維持在完全抽出爐心的位置。

B. 調壓槽功能異常造成反應器冷卻水系統壓力減少 20 psig。

C. 運轉員將反應器冷卻水硼濃度減少 5 ppm，控制棒沒有移動。

D. 爐心的 Xe-135 燃耗量與軸向及徑向功率分佈成正比，控制棒沒有移動。

答案：A.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P2788(N/A)

A nuclear power plant is operating with the following initial conditions:

- Reactor power is 45% in the middle of a fuel cycle.
- Axial and radial power distributions are peaked in the center of the core.

Which one of the following will increase the steady-state departure from nucleate boiling ratio?

A. Core Xe-135 decays with no change in the axial and radial power distributions.

B. A reactor trip occurs and one control rod remains fully withdrawn from the core.

C. The operator decreases reactor coolant boron concentration by 5 ppm with no control rod motion.

D. A pressurizer malfunction decreases reactor coolant system pressure by 20 psig with no control rod motion.

ANSWER: B.

核能電廠以下列初始條件運轉：

- 反應器為燃料週期中期，功率為 45%。
- 軸向與徑向功率分佈於爐心中央達到尖峰。

下列何者將增加穩態偏離核沸騰比？

A. 爐心 Xe-135 的衰變，不改變軸向與徑向功率分佈。

B. 反應器發生急停且一根控制棒仍維持在完全抽出爐心的位置。

C. 運轉員將反應器冷卻水硼濃度減少 5 ppm，控制棒沒有移動。

D. 調壓槽功能異常造成反應器冷卻水系統壓力減少 20 psig，控制棒沒有移動。

答案：B.

科目： 193008
知能類：K1.05 [3.4/3.6]
序號： P2989(N/A)

A nuclear reactor is shut down at normal operating temperature and pressure with all control rods inserted. Which one of the following will decrease the departure from nucleate boiling ratio for this reactor? (Assume the reactor remains shutdown.)

A. Fully withdrawing a bank of shutdown rods.

B. Diluting RCS boron concentration by 50 ppm.

C. Reducing RCS temperature by 5°F.

D. Decreasing RCS pressure by 10 psig.

ANSWER: D.

一部核子反應器於正常運轉溫度及壓力下停機，所有控制棒均插入。下列何者將減少該反應器的偏離核沸騰比？(假設反應器仍然停機)

A. 將一停機棒組完全抽出。

B. RCS 硼濃度稀釋 50 ppm。

C. 降低 RCS 溫度 5°F。

D. 減少 RCS 壓力 10 psig。

答案：D.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P87

Which one of the following parameter changes would move a nuclear reactor farther away from the critical heat flux?

A. Decrease pressurizer pressure

B. Decrease reactor coolant flow

C. Decrease reactor power

D. Increase reactor coolant temperature

ANSWER: C.

下列那項參數變化將使核子反應器更偏離臨界熱通率？

A. 調壓槽壓力降低。

B. 反應器冷卻水流減少。

C. 反應器功率降低。

D. 反應器冷卻水溫升高。

答案：C.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P145 (B1888)

How does critical heat flux vary from the bottom to the top of the nuclear reactor core during normal full power operation?

A. Increases continuously

B. Increases, then decreases

C. Decreases continuously

D. Decreases, then increases

ANSWER: C.

核子反應器以正常全功率運轉時，其爐心從底部至頂部的臨界熱通率變化為何？

A. 持續增加。

B. 先增加再減少。

C. 持續減少。

D. 先減少再增加。

答案：C.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P587

The heat transfer rate that causes departure from nucleate boiling is the...

A. critical heat flux.

B. nucleate heat flux.

C. transition heat flux.

D. departure heat flux.

ANSWER: A.

造成偏離核沸騰的傳熱率為……

A. 臨界熱通率

B. 核熱通率

C. 變態熱通率(transition heat flux)

D. 偏離熱通率

答案：A.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P989

Critical heat flux is the heat transfer rate per unit _____ of fuel rod that will initially cause _____.

A. volume; nucleate boiling

B. area; nucleate boiling

C. volume; departure from nucleate boiling

D. area; departure from nucleate boiling

ANSWER: D.

臨界熱通率為初始造成燃料棒_____的每單位_____傳熱率。

A. 核沸騰；體積

B. 核沸騰；面積

C. 偏離核沸騰；體積

D. 偏離核沸騰；面積

答案：D.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P1087

How does critical heat flux (CHF) vary with core height during normal full power operation of the nuclear reactor?

A. CHF increases from the bottom to the top of the core.

B. CHF decreases from the bottom to the core midplane, then increases from the midplane to the top of the core.

C. CHF decreases from the bottom to the top of the core.

D. CHF increases from the bottom to the core midplane, then decreases from the midplane to the top of the core.

ANSWER: C.

核子反應器以全功率正常運轉時，臨界熱通率(CHF)如何隨著爐心高度而變化？

A. CHF 從爐心底部增加至頂部。

B. CHF 從爐心底部減至中間平面，然後從中間平面增至爐心頂部。

C. CHF 從爐心底部減至頂部。

D. CHF 從爐心底部增至中間平面，然後從中間平面減至爐心頂部。

答案：C.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P1586

A nuclear reactor is operating at steady-state 75% power. Which one of the following parameter changes will cause the core to operate closer to critical heat flux? (Assume reactor power does not change unless stated.)

A. Decrease reactor coolant flow by 5%.

B. Decrease reactor power by 10%.

C. Decrease reactor coolant temperature by 3°F.

D. Increase pressurizer pressure by 20 psia.

ANSWER: A.

一部核子反應器以 75%功率穩態運轉。下列那項參數變化將造成爐心以近似臨界熱通率的情況運轉？(假設反應器功率在未指明之下維持不變)

A. 反應器冷卻水流減少 5%。

B. 反應器功率減少 10%。

C. 反應器冷卻水溫減少 3°F。

D. 調壓槽壓力增加 20 psia。

答案：A.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P2187

Which one of the following will be the initial cause of fuel damage if a fuel rod exceeds the critical heat flux at 100% power?

A. Excessive fuel clad temperature

B. Excessive fuel pellet temperature

C. Excessive fuel rod internal pressure

D. Excessive fuel rod thermal stress

ANSWER: A.

如果燃料棒在 100%功率時超過臨界熱通率，下列何者為燃料受損的初步原因？

A. 燃料護套溫度過高。

B. 燃料丸溫度過高。

C. 燃料棒內部壓力過高。

D. 燃料棒熱應力過高。

答案：A.

科目： 193008
知能類：K1.06 [2.8/2.9]
序號： P3587 (B1997)

Which one of the following is most likely to result in fuel clad damage?

A. Operating at 110% of reactor vessel design pressure.

B. An inadvertent reactor trip from 100% power.

C. Operating at a power level that exceeds the critical heat flux.

D. Operating with subcooled nucleate boiling occurring in a fuel assembly.

ANSWER: C.

下列何者最可能造成燃料護套受損？

A. 以 110%的反應爐設計壓力運轉。

B. 反應器從 100%功率意外急停。

C. 以超過臨界熱通率的功率運轉。

D. 在燃料元件表面發生次冷核沸騰之下運轉。

答案：C.

科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P588 (B1885)

Select the statement that describes the effect of transition (partial film) boiling at the fuel clad surface-to-coolant interface.

A. A small increase in heat flux requires a large increase in fuel clad temperature because of increased fuel rod steam blanketing.

B. The temperature of the fuel clad surface is so high that thermal radiation heat transfer becomes significant, which causes heat flux to rapidly increase.

C. A small increase in heat flux increases the formation of steam bubbles causing increased turbulence in the liquid boundary layer, consequently decreasing clad temperature.

D. As the heat flux increases, a few vapor bubbles are formed but collapse when they enter into the bulk of the fluid, which decreases clad temperature.

ANSWER: A.

關於燃料護套表面與冷卻水介面的變態(部分薄膜)沸騰效應，下列何者描述為真？

A. 燃料護套溫度需要大幅增加，方能小幅增加熱通率，這是燃料棒蒸汽膜(steam blanket)增加所致。

B. 燃料護套表面溫度很高，因而輻射熱傳(thermal radiation heat transfer)重要性增加，而導致熱通率快速增加。

C. 熱通率小幅增加而增加形成的汽泡，導致液體邊界層(boundary layer)的擾動增加，結果降低護套溫度。

D. 當熱通率增加時，一些汽泡形成，但是當其進入整體流體時凝結消失(collapse)，因而降低護套溫度。

答案：A.

科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P689

A small increase in ΔT (at the fuel clad-to-coolant interface) causes increased steam blanketing and a reduction in heat flux. This describes which type of boiling?

A. Subcooled boiling

B. Nucleate boiling

C. Partial film boiling

D. Total film boiling

ANSWER: C.

ΔT(位於燃料護套至冷卻水的介面)小幅增加，造成蒸汽包覆增加且熱通率減少。此情況描述的是那種沸騰？

A. 次冷沸騰

B. 核沸騰

C. 部分薄膜沸騰

D. 整體薄膜沸騰

答案：C.

科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P789 (B788)

Following a nuclear reactor accident, transition boiling is occurring near the top of one fuel assembly coolant channel. At the coolant channel elevation where the onset of transition boiling is occurring, coolant flow is changing from _____ flow to _____ flow.

A. annular; slug

B. annular; vapor

C. bubbly; slug

D. bubbly; vapor

ANSWER: B.

核子反應器發生事故後，一燃料元件冷卻水通道頂部附近發生變態沸騰。在發生變態沸騰的冷卻水通道高度，其冷卻水流從_____改變為_____。

A. 環形流(annular flow)；團狀流(slug flow)

B. 環形流；蒸汽流(vapor flow)

C. 氣泡流(bubbly flow)；團狀流

D. 氣泡流；蒸汽流

答案：B.

科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P1089

Refer to the drawing of a pool boiling curve (see figure below).

Choose the region of the curve where transition boiling is the primary heat transfer process.

A. Region I

B. Region II

C. Region III

D. Region IV

ANSWER: C.

請參照下圖的池式沸騰曲線。

請問在哪一區域的曲線，其主要熱傳過程為變態沸騰？

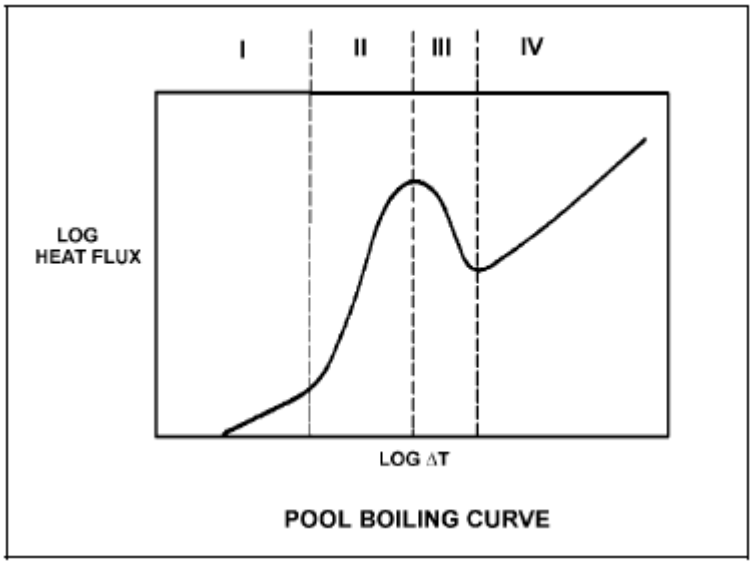
A. I 區

B. II 區

C. III 區

D. IV 區

答案：C.



科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P1689 (B1386)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the points shown represents the onset of transition boiling?

A. A

B. B

C. C

D. D

ANSWER: B.

請參照下圖的池式沸騰曲線。

哪一點代表變態沸騰開始？

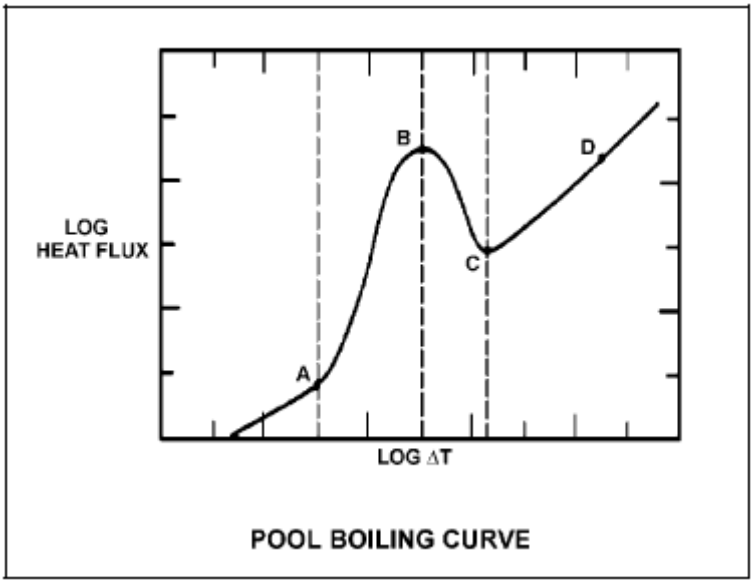
A. A

B. B

C. C

D. D

答案：B.



科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P1891 (B987)

Which one of the following describes the conditions in a fuel coolant channel that is experiencing transition boiling?

A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Saturated nucleate boiling

D. Subcooled nucleate boiling

ANSWER: B.

下列何者描述了正處於變態沸騰的燃料冷卻水通道狀況？

A. 蒸汽完全覆蓋燃料棒表面。

B. 燃料棒表面濕乾交替。

C. 飽和核沸騰。

D. 次冷核沸騰。

答案：B.

科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P1987 (B2288)

Which one of the following describes the conditions in a fuel channel that is experiencing transition boiling?

A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Steam bubbles form and collapse on the fuel rod surface

D. Steam bubbles form on the fuel rod surface and are swept away by subcooled bulk coolant

ANSWER: B.

下列何者描述了燃料通道內正處於變態沸騰的情況？

A. 蒸汽完全覆蓋燃料棒表面。

B. 燃料棒表面濕乾交替。

C. 汽泡在燃料棒表面形成與凝結消失(collapse)。

D. 汽泡在燃料棒表面形成，其後被次冷整體冷卻水(subcooled bulk coolant)掃除。

答案：B.

科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P2188(B2185)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the following describes the conditions in a fuel channel that is experiencing region III heat transfer?

A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Saturated nucleate boiling

D. Subcooled nucleate boiling

ANSWER: B.

請參照下圖的池式沸騰曲線。

下列何者描述了燃料通道內正處於III區熱傳的情形？

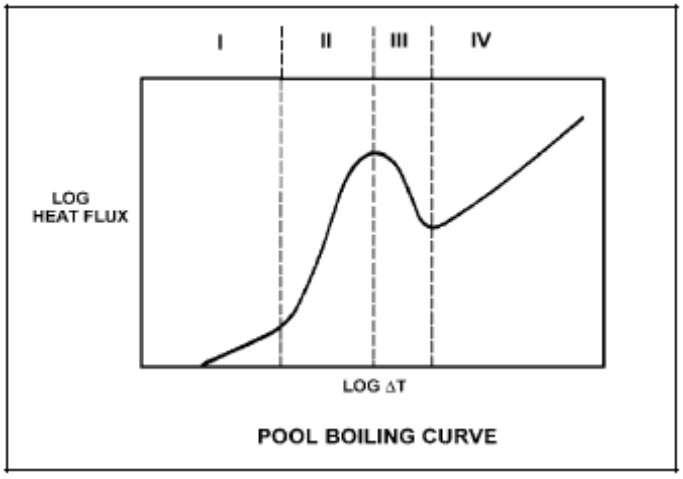
A. 蒸汽完全覆蓋燃料棒表面。

B. 燃料棒表面濕乾交替。

C. 飽和核沸騰。

D. 次冷核沸騰。

答案：B.



科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P2289(B289) (B2688)

Refer to the drawing of a pool-boiling curve (see figure below).

The point at which heat flux stops increasing and the critical heat flux has been reached (point B), marks the beginning of...

A. nucleate boiling.

B. stable film boiling.

C. partial film boiling.

D. single-phase convection.

ANSWER: C.

請參照下圖的池式沸騰曲線。

在圖中，熱通量停止增加且到達臨界熱通率的一點(點B)，代表何者的開始？

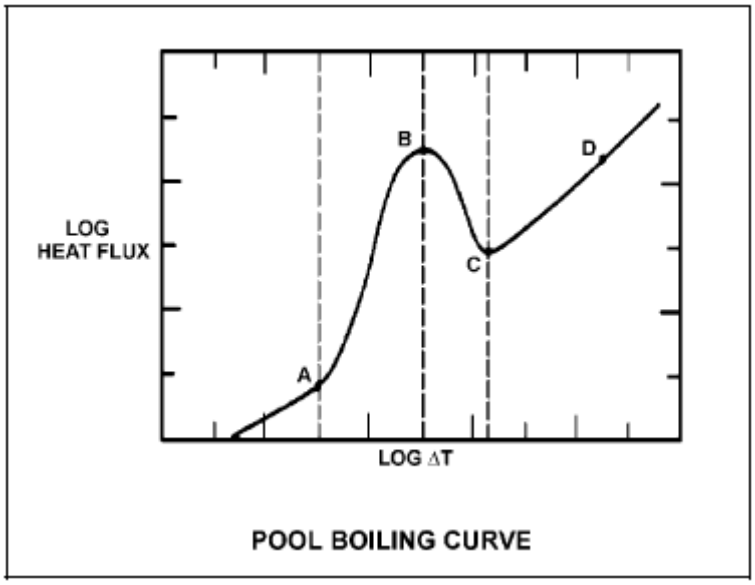
A. 核沸騰

B. 穩定薄膜沸騰

C. 部分薄膜沸騰(partial film boiling)

D. 單相對流

答案：C.



科目： 193008
知能類：K1.07 [2.6/2.6]
序號： P2688(B1486)

Refer to the drawing of a pool-boiling curve (see figure below).

Which one of the following regions represents the most unstable heat transfer?

A. I

B. II

C. III

D. IV

ANSWER: C.

請參照下圖的池式沸騰曲線。

哪一區域代表的熱傳最不穩定？

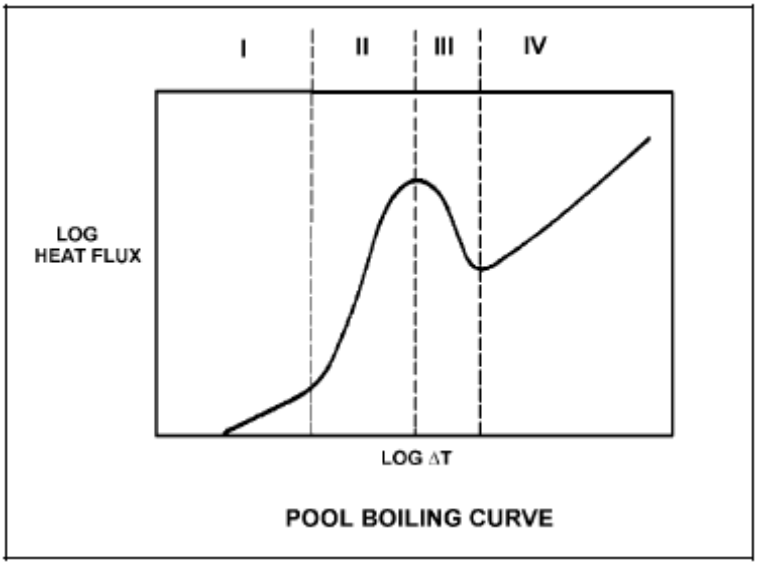
A. I

B. II

C. III

D. IV

答案：C.



科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P88

Film boiling is...

A. the most efficient method of boiling heat transfer.

B. heat transfer through an oxide film on the cladding.

C. heat transfer being accomplished with no enthalpy change.

D. heat transfer through a vapor blanket that covers the fuel cladding.

ANSWER: D.

薄膜沸騰是……

A. 最有效率的沸騰熱傳法。

B. 透過護套上的氧化膜傳熱。

C. 在焓沒有變化下完成熱傳。

D. 透過覆蓋燃料護套的蒸汽來傳熱。

答案：D.

科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P139

Reactor power is increased sufficiently to cause steam blanketing of several fuel rods. This condition is being caused by...

A. departure from nucleate boiling.

B. subcooled nucleate boiling.

C. saturated nucleate boiling.

D. onset of nucleate boiling.

ANSWER: A.

若反應器功率增加到足以使某些燃料棒表面發生蒸汽膜覆蓋，此情況是由下列何者造成？

A. 偏離核沸騰

B. 次冷核沸騰

C. 飽和核沸騰

D. 核沸騰開始

答案：A.

科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P889 (B1987)

If the fission rate in a nuclear reactor core steadily increases, the mode of heat transfer that occurs immediately after the critical heat flux is reached is called...

A. transition boiling.

B. subcooled nucleate boiling.

C. saturated nucleate boiling.

D. stable film boiling.

ANSWER: A.

若核子反應器爐心之分裂率穩定增加，達到臨界熱通率後立刻發生的熱傳模式稱為……

A. 變態沸騰

B. 次冷核沸騰

C. 飽和核沸騰

D. 穩定薄膜沸騰(stable film boiling)

答案：A.

科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P1587 (B1587)

Refer to the drawing of a pool-boiling curve (see figure below).

Which one of the points shown marks the lowest ΔT at which stable film boiling can exist?

A. A

B. B

C. C

D. D

ANSWER: C.

請參照下圖的池式沸騰曲線。

圖中那一個點代表了穩定薄膜沸騰能夠存在的最低ΔT？

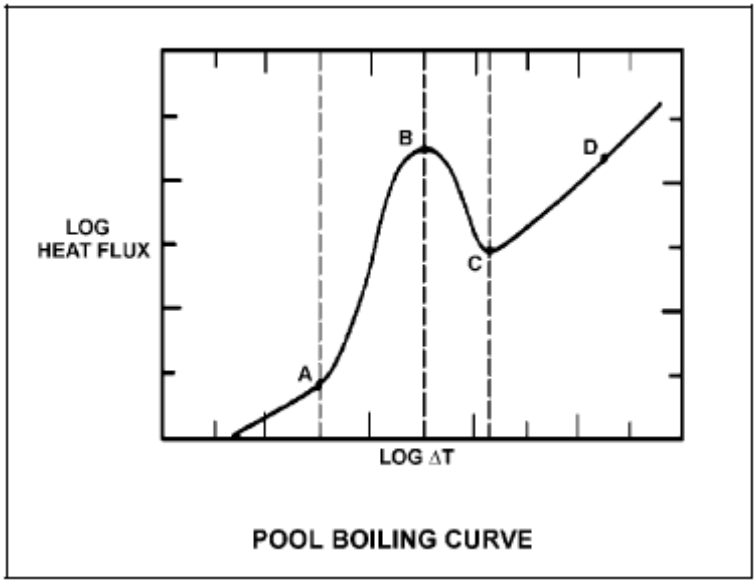
A. A

B. B

C. C

D. D

答案：C.



科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P2189 (B687)

Which one of the following describes the relative contributions of the convective and radiative heat transfer mechanisms, and the relationship of ΔT (T_{wall} - T_{bulk}) to heat flux, during stable film boiling heat transfer in the core?

A. Only the radiative heat transfer mechanism is significant and ΔT increases exponentially with heat flux.

B. Only the radiative heat transfer mechanism is significant and ΔT increases in direct proportion to heat flux.

C. Both heat transfer mechanisms are significant and ΔT increases exponentially with heat flux.

D. Both heat transfer mechanisms are significant and ΔT increases in direct proportion to heat flux.

ANSWER: A.

爐心進行穩定薄膜沸騰(stable film boiling)熱傳時，下列何者描述了對流及輻射熱傳(thermal radiation heat transfer)機制的相對貢獻，以及ΔT(T_{wall} - T_{bulk})對熱通率的關係？

A. 只有輻射熱傳機制顯著，ΔT隨著熱通率成指數增加。

B. 只有輻射熱傳機制顯著，ΔT隨著熱通率成正比增加。

C. 兩種熱傳機制均顯著，ΔT隨著熱通率成指數增加。。

D. 兩種熱傳機制均顯著，ΔT隨著熱通率成正比增加。

答案：A.

科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P2588 (B2588)

Refer to the drawing of a pool boiling curve (see figure below).

Which one of the following describes the conditions in a fuel channel that is experiencing region IV heat transfer?

A. Complete steam blanketing of the fuel rod surface

B. Alternate wetting and drying of the fuel rod surface

C. Saturated nucleate boiling

D. Subcooled nucleate boiling

ANSWER: A.

請參照下圖的池式沸騰曲線。

下列何者描述了燃料通道內正處於區域IV熱傳之現象？

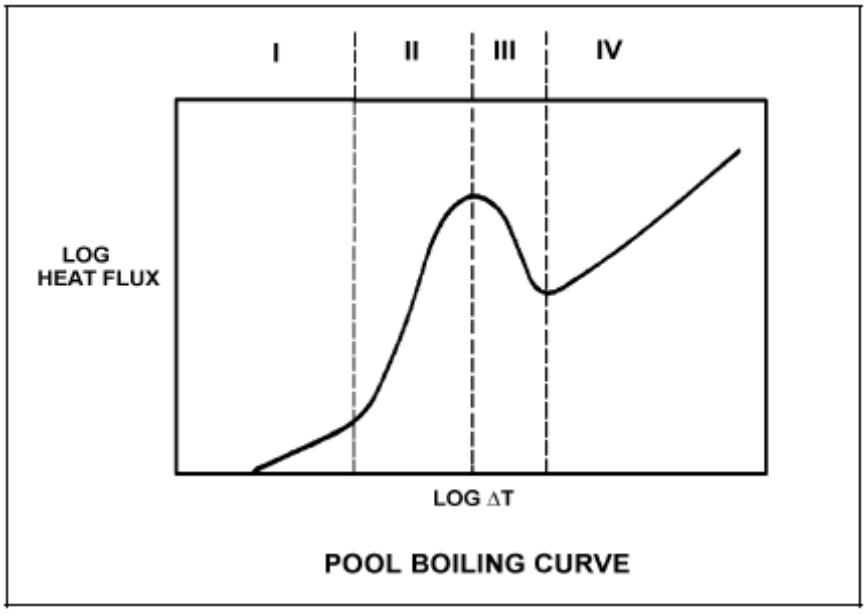
A. 蒸汽完全覆蓋燃料棒表面。

B. 燃料棒表面濕乾交替。

C. 飽和核沸騰。

D. 次冷核沸騰。

答案：A.



科目： 193008
知能類：K1.08 [2.6/2.6]
序號： P3488(B3485)

During a loss of coolant accident, the reactor fuel may experience stable film boiling. Which one of the following types of heat transfer from the fuel cladding will increase significantly when stable film boiling begins?

A. Forced convection

B. Natural convection

C. Conduction

D. Radiation

ANSWER: D.

在冷卻水流失事故中，反應器燃料可能經歷穩定薄膜沸騰(stable film boiling)。當穩定薄膜沸騰開始時，那種燃料護套熱傳形式將顯著增加？

A. 強制對流

B. 自然對流

C. 傳導

D. 輻射

答案：D.

科目： 193008
知能類：K1.10 [2.9/3.1]
序號： P89

The departure from nucleate boiling (DNB) ratio is defined as the...

A. actual heat flux divided by the critical heat flux at any point along a fuel rod.

B. critical heat flux divided by the actual heat flux at any point along a fuel rod.

C. core thermal power divided by the total reactor coolant mass flow rate.

D. number of coolant channels that have reached DNB divided by the number of coolant channels that are subcooled.

ANSWER: B.

偏離核沸騰(DNB)比的定義為……

A. 燃料棒上任一點的實際熱通率除以臨界熱通率。

B. 燃料棒上任一點的臨界熱通率除以實際熱通率。

C. 爐心熱功率除以反應器冷卻水的總質量流率。

D. 到達 DNB 的冷卻水通道數，除以次冷冷卻水通道數。

答案：B.

科目： 193008
知能類：K1.10 [2.9/3.1]
序號： P289

In the definition of the departure from nucleate boiling ratio, the term "actual heat flux" refers to the...

A. heat transfer rate per unit area at any point along the fuel rod.

B. average heat transfer rate per unit area across the core.

C. integrated heat transfer rate along the entire fuel rod.

D. total heat transfer rate along the entire fuel rod.

ANSWER: A.

偏離核沸騰比的定義中，「實際熱通率」一詞意指……

A. 燃料棒上任一點的每單位面積熱傳率。

B. 爐心的每單位面積平均熱傳率。

C. 整根燃料棒的合併熱傳率。

D. 整根燃料棒的總熱傳率。

答案：A.

科目： 193008
知能類：K1.10 [2.9/3.1]
序號： P990

A nuclear reactor is operating at 100% steady-state power at the end of core life with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the minimum departure from nucleate boiling ratio occur?

A. At the bottom of the fuel assembly

B. At the top of the fuel assembly

C. Between the bottom and the midplane of the fuel assembly

D. Between the midplane and the top of the fuel assembly

ANSWER: D.

一部處於爐心壽命末期的核子反應器以 100%穩態功率運轉，所有控制棒均完全抽出。請問標準燃料元件的那一軸向位置，將產生最低的偏離核沸騰比？

A. 燃料元件底部。

B. 燃料元件頂部。

C. 燃料元件底部與中間平面之間。

D. 燃料元件中間平面與頂部之間。

答案：D.

科目： 193008
知能類：K1.10 [2.9/3.1]
序號： P1190

A nuclear reactor is operating at 100% steady-state power near the end of core life with all control rods fully withdrawn. At what axial location in a typical fuel assembly will the maximum departure from nucleate boiling ratio occur?

A. At the top of the fuel assembly

B. At the bottom of the fuel assembly

C. Between the bottom and midplane of the fuel assembly

D. Between the midplane and the top of the fuel assembly

ANSWER: B.

一部接近爐心壽命末期的核子反應器以 100%穩態功率運轉，所有控制棒完全抽出。請問標準燃料元件的那一軸向位置，將產生最高的偏離核沸騰比？

A. 燃料元件頂部。

B. 燃料元件底部。

C. 燃料元件底部與中間平面之間。

D. 燃料元件中間平面與頂部之間。

答案：B.

科目： 193008
知能類：K1.10 [2.9/3.1]
序號： P2590

If a nuclear reactor is operating with DNBR at its limit, which one of the following is indicated?

A. None of the fuel rods are experiencing critical heat flux.

B. A small fraction of the fuel rods may be experiencing critical heat flux.

C. All radioactive fission products are being contained within the reactor fuel.

D. All radioactive fission products are being contained within either the reactor fuel or the reactor vessel.

ANSWER: B.

核子反應器若以偏離核沸騰比(DNBR)限值運轉，意指下列那種情況？

A. 所有燃料棒都沒有經歷臨界熱通率。

B. 少數燃料棒可能經歷臨界熱通率。

C. 所有輻射分裂(radioactive fission)產物被限制在反應器燃料內。

D. 所有輻射分裂產物被限制在反應器燃料或反應爐內。

答案：B.

科目： 193008
知能類：K1.14 [2.6/2.7]
序號： P389 (B588)

Core heat transfer is maximized by the presence of...

A. laminar flow with no nucleate boiling.

B. turbulent flow with no nucleate boiling.

C. laminar flow with nucleate boiling.

D. turbulent flow with nucleate boiling.

ANSWER: D.

下列何者的出現將爐心熱傳增至最大？

A. 不具核沸騰的層流。

B. 不具核沸騰的擾流。

C. 具核沸騰的層流。

D. 具核沸騰的擾流。

答案：D.

科目： 193008
知能類：K1.14 [2.6/2.7]
序號： P690

The heat transfer coefficient of the core will be directly increased if: (Assume bulk coolant subcooling.)

A. the coolant temperature is decreased.

B. the coolant flow rate is decreased.

C. nucleate boiling occurs in the coolant.

D. the coolant flow is laminar instead of turbulent.

ANSWER: C.

發生下列何種情形時，將直接增加爐心熱傳係數？(假設整體冷卻水次冷)

A. 冷卻水溫度降低。

B. 冷卻水流率減少。

C. 冷卻水發生核沸騰。

D. 冷卻水是層流而非擾流。

答案：C.

科目： 193008
知能類：K1.14 [2.6/2.7]
序號： P891

Increasing coolant flow rate through the nuclear reactor core improves heat transfer from the fuel because it _____ the laminar film thickness and _____ the temperature of the coolant adjacent to the fuel.

A. increases; increases

B. increases; decreases

C. decreases; increases

D. decreases; decreases

ANSWER: D.

增加通過核子反應器爐心的冷卻水流率，將改善燃料熱傳情形，這是因為層狀薄膜厚度_____，並_____燃料附近的冷卻水溫。

A. 增加；升高

B. 增加；降低

C. 減少；升高

D. 減少；降低

答案：D.

科目： 193008
知能類：K1.14 [2.6/2.7]
序號： P1691

Which one of the following will minimize core heat transfer?

A. Laminar flow with no nucleate boiling

B. Turbulent flow with no nucleate boiling

C. Laminar flow with nucleate boiling

D. Turbulent flow with nucleate boiling

ANSWER: A.

下列何者將使爐心熱傳降至最低？

A. 不具核沸騰的層流。

B. 不具核沸騰的擾流。

C. 具核沸騰的層流。

D. 具核沸騰的擾流。

答案：A.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P90

A nuclear power plant is operating at 100% power. The reactor coolant subcooling margin will be directly reduced by:

A. increasing reactor coolant temperature.

B. increasing pressurizer pressure.

C. increasing reactor coolant flow.

D. increasing pressurizer level.

ANSWER: A.

已知核能電廠以 100%功率運轉，下列何者將直接減少反應器冷卻水次冷餘裕？

A. 反應器冷卻水溫升高。

B. 調壓槽壓力增加。

C. 反應器冷卻水流增加。

D. 調壓槽水位升高。

答案：A.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P290

The difference between the actual temperature and the saturation temperature of a liquid is the...

A. critical heat flux.

B. subcooling margin.

C. departure from nucleate boiling.

D. saturation margin.

ANSWER: B.

液體的實際溫度與飽和溫度的溫差為……

A. 臨界熱通率

B. 次冷餘裕

C. 偏離核沸騰

D. 飽和餘裕

答案：B.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P393

Which one of the following must be present to assure adequate core cooling following a small loss-of-coolant accident?

A. Emergency cooling injection flow rate on scale

B. Pressurizer level in the indicating range

C. Subcooling margin greater than zero

D. Pressurizer pressure greater than safety injection actuation setpoint

ANSWER: C.

發生少量冷卻水流失事故後，為了確保爐心充分冷卻，必須具備下列那一條件？

A. 緊急冷卻水注入流率符合設計要求。

B. 調壓槽水位處於指示範圍。

C. 次冷餘裕大於零。

D. 調壓槽壓力大於安全注入啟動(actuation)設定點。

答案：C.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P992

Which one of the following will increase the reactor coolant system (RCS) subcooling margin with the reactor operating at full power?

A. Decreased RCS pressure

B. Decreased RCS hot leg temperature

C. Increased RCS cold leg temperature

D. Increased concentration of soluble gases in the RCS

ANSWER: B.

反應器以全功率運轉時，下列何者將增加反應器冷卻水系統(RCS)的次冷餘裕？

A. RCS 壓力減少。

B. RCS 熱端溫度降低。

C. RCS 冷端溫度升高。

D. RCS 的可溶解氣體濃度增加。

答案：B.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P1491

During a 60°F/hour reactor coolant system (RCS) cooldown and depressurization with natural circulation, RCS subcooling will be minimum in the...

A. reactor vessel head.

B. RCS loop hot leg.

C. RCS loop cold leg.

D. reactor core.

ANSWER: A.

反應器冷卻水系統(RCS)以 60°F/hr 的降溫率，利用自然循環冷卻減壓時，RCS 次冷度於何處最小？

A. 反應爐頂部。

B. RCS 迴路熱端。

C. RCS 迴路冷端。

D. 反應器爐心。

答案：A.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P2090

A reactor coolant system cooldown and depressurization is in progress on natural circulation following a loss of offsite power. The following conditions exist:

RCS Tcold: 520°F, decreasing
RCS Thot: 538°F, decreasing
Pressurizer pressure: 2000 psia, decreasing

If cooldown rate is being maintained at 50°F/hour, which one of the following locations is most likely to experience steam formation?

A. Reactor vessel head

B. RCS loop hot leg

C. Steam generator U-tubes

D. Reactor core

ANSWER: A.

反應器冷卻水系統於喪失外電後，以自然循環進行降溫減壓。此時的條件如下：

RCS Tcold： 520°F，減少中
RCS Thot： 538°F，減少中
調壓槽壓力： 2000 psia，減少中

如果降溫速率維持在 50°F/hr，下列那一處最有可能形成蒸汽？

A. 反應爐頂部

B. RCS 迴路熱端

C. 蒸汽產生器 U 形管

D. 反應器爐心

答案：A.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P2591

Which one of the following is most likely to result in steam bubble formation in a reactor vessel head while maintaining a 60°F subcooling margin in the hottest RCS hot leg?

A. Performing a 25°F/Hr RCS cooldown on natural circulation.

B. Performing a 50°F/Hr RCS cooldown on natural circulation.

C. Performing a 25°F/Hr RCS heatup on forced circulation.

D. Performing a 50°F/Hr RCS heatup on forced circulation.

ANSWER: B.

溫度最高的反應器冷卻水系統(RCS)熱端仍維持 60°F 次冷餘裕時，下列何者最有可能造成反應爐頂部產生汽泡？

A. RCS 以 25°F/Hr 的自然循環冷卻。

B. RCS 以 50°F/Hr 的自然循環冷卻。

C. RCS 以 25°F/Hr 的強制循環加熱。

D. RCS 以 50°F/Hr 的強制循環加熱。

答案：B.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P2790 (N/A)

Which one of the following is most likely to result in steam bubble formation in a reactor vessel head while maintaining a 40°F subcooling margin in the hottest RCS hot leg?

A. Performing a 25°F/Hr RCS cooldown on natural circulation.

B. Performing a 25°F/Hr RCS cooldown on forced circulation.

C. Performing a 50°F/Hr RCS cooldown on natural circulation.

D. Performing a 50°F/Hr RCS cooldown on forced circulation.

ANSWER: C.

溫度最高的反應器冷卻水系統(RCS)熱端仍維持 40°F 次冷餘裕時，下列何者最有可能造成反應爐頂部產生汽泡？

A. RCS 以 25°F/Hr 的自然循環冷卻。

B. RCS 以 25°F/Hr 的強制循環冷卻。

C. RCS 以 50°F/Hr 的自然循環冷卻。

D. RCS 以 50°F/Hr 的強制循環冷卻。

答案：C.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P2890

A nuclear power plant maintains the reactor coolant system (RCS) cold leg temperature (T_{cold}) at 557°F from 0% to 100% power. At 100% power, the reactor differential temperature (T_{hot} - T_{cold}) is 60°F.

If this plant also maintains RCS pressure constant at 2235 psig, which one of the following is the approximate RCS subcooling margin at 50% power?

A. 30°F

B. 36°F

C. 66°F

D. 96°F

ANSWER: C.

核能電廠功率從 0%增至 100%時，反應器冷卻水系統(RCS)冷端溫度(T_{cold})維持在 557°F。反應器功率為 100%時，其溫差($T_{hot} - T_{cold}$)為 60°F。

如果該電廠亦將 RCS 壓力維持在 2235 psig，請問功率為 50%時，RCS 次冷餘裕約為多少？

A. 30°F

B. 36°F

C. 66°F

D. 96°F

答案：C.

科目： 193008
知能類：K1.15 [3.6/3.8]
序號： P2991 (N/A)

Assume that a 30°F subcooling margin is maintained in the reactor coolant system (RCS) hot legs during each of the following shutdown reactor cooldown operations. Which one of the following will maintain the greatest subcooling margin in the reactor vessel head?

A. Performing a 25°F/Hr RCS cooldown on natural circulation using one steam generator.

B. Performing a 25°F/Hr RCS cooldown with all reactor coolant pumps running.

C. Performing a 100°F/Hr RCS cooldown on natural circulation using all steam generators.

D. Performing a 100°F/Hr RCS cooldown with one reactor coolant pump running.

ANSWER: B.

假設在每次反應器停機冷卻運轉中，反應器冷卻水系統(RCS)熱端都能維持 30°F 次冷餘裕。下列那項動作能使反應爐頂部維持最大的次冷餘裕？

A. 利用一部蒸汽產生器，以 25°F/Hr 的自然循環冷卻 RCS。

B. 所有反應器冷卻水泵均運轉下，以 25°F/Hr 的速度冷卻 RCS。

C. 利用所有蒸汽產生器，以 100°F/Hr 的自然循環冷卻 RCS。

D. 一個反應器冷卻水泵運轉下，以 100°F/Hr 的速度冷卻 RCS。

答案：B.

科目： 193008
知能類：K1.16 [2.4/2.6]
序號： P391 (B1989)

Refer to the drawing of a fuel rod and coolant flow channel at the beginning of a fuel cycle (see figure below).

At 100% reactor power, the greatest temperature difference in a fuel channel radial temperature profile will occur across the: (Assume the temperature profile begins at the fuel centerline.)

A. fuel pellet centerline to pellet surface.

B. fuel-to-clad gap.

C. zircaloy cladding.

D. flow channel boundary (laminar) layer.

ANSWER: A.

請參照下圖中，處於燃料週期初期的燃料棒與冷卻水流通道。

在100%反應器功率下，燃料通道徑向溫度分佈中最大的溫差將發生在何處：(假設溫度分佈始於燃料中線)

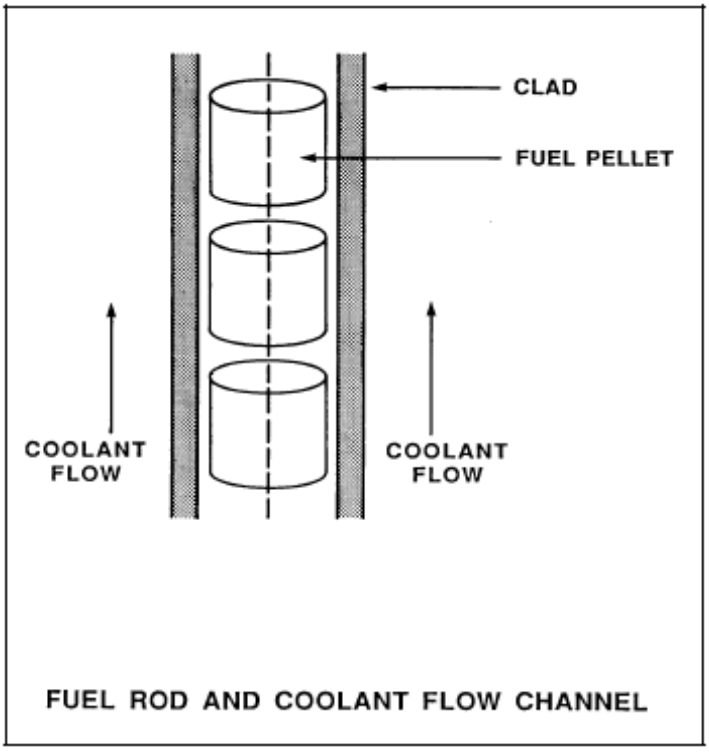
A. 燃料丸中線至燃料丸表面。

B. 燃料至護套之間隙。

C. 鋯合金護套。

D. 流道邊界(層流/laminar)層。

答案：A.



FUEL ROD AND COOLANT FLOW CHANNEL

科目： 193008
知能類：K1.17 [2.9/3.2]
序號： P692

During a plant cooldown and depressurization with forced circulation, reactor coolant system (RCS) loop flow and reactor coolant pump (RCP) current indications become erratic. These abnormal indications are most likely caused by...

A. RCP cavitation.

B. RCP runout.

C. RCS loop water hammer.

D. RCS hot leg saturation.

ANSWER: A.

電廠以強制循環降溫減壓時，反應器冷卻水系統(RCS)迴路水流及反應器冷卻水泵(RCP)電流指示值變得不穩。最有可能造成這些指示值異常的原因為何？

A. RCP 孔蝕

B. RCP 超流(runout)

C. RCS 迴路發生水錘現象

D. RCS 熱端飽和

答案：A.

科目： 193008
知能類：K1.18 [2.3/2.5]
序號： P1790 (B1789)

Single-phase coolant flow resistance (head loss) in a nuclear reactor core is directly proportional to the square of coolant _____ and inversely proportional to _____.

A. velocity; fuel assembly length

B. temperature; fuel assembly length

C. velocity; coolant channel cross-sectional area

D. temperature; coolant channel cross-sectional area

ANSWER: C.

核子反應器爐心的單相冷卻水流動阻力(水頭損失)，與冷卻水_____的平方直接成正比，同時與_____成反比。

A. 速度；燃料元件長度

B. 溫度；燃料元件長度

C. 速度；冷卻水通道截面積

D. 溫度；冷卻水通道截面積

答案：C.

科目： 193008
知能類：K1.19 [2.5/2.8]
序號： P1192

A nuclear reactor is producing 3,400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.4 x 10^8 lbm/hour. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 7.92 x 10^6 lbm/hour

B. 8.40 x 10^6 lbm/hour

C. 1.26 x 10^8 lbm/hour

D. 1.32 x 10^8 lbm/hour

ANSWER: A.

核子反應器產生 3,400 MW 的熱輸出，其爐心 ΔT 為 60°F、質量流率為 1.4 x 10^8 lbm/hr。如果爐心 ΔT 為 63.6°F，爐心旁通流率為多少？(假設旁通水流 ΔT 等於 0°F)

A. 7.92 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 1.26 x 10^8 lbm/hr

D. 1.32 x 10^8 lbm/hr

答案：A.

科目： 193008
知能類：K1.19 [2.5/2.8]
序號： P1886

A nuclear reactor is producing 3400 MW of thermal output with a vessel ΔT of 60°F and a vessel mass flow rate of 1.0 x 10^8 lbm/hr. If core ΔT is 63.6°F, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 5.66 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 3.60 x 10^7 lbm/hr

D. 9.43 x 10^7 lbm/hr

ANSWER: A.

核子反應器產生 3400 MW 的熱輸出，其爐心 ΔT 為 60°F、質量流率為 1.0 x 10^8 lbm/hr。如果爐心 ΔT 為 63.6°F，爐心旁通流率為多少？(假設旁通水流 ΔT 等於 0°F)

A. 5.66 x 10^6 lbm/hr

B. 8.40 x 10^6 lbm/hr

C. 3.60 x 10^7 lbm/hr

D. 9.43 x 10^7 lbm/hr

答案：A.

科目： 193008
知能類：K1.19 [2.5/2.8]
序號： P2291

A nuclear reactor is producing 3400 MW of thermal output with a vessel differential temperature (ΔT) of 60°F and a vessel mass flow rate of 1.1 x 10^8 lbm/hr. If core ΔT is 63.6EF, what is core bypass flow rate? (Assume bypass flow ΔT equals 0°F.)

A. 5.66 x 10^6 lbm/hr

B. 6.23 x 10^6 lbm/hr

C. 5.66 x 10^7 lbm/hr

D. 6.23 x 10^7 lbm/hr

ANSWER: B.

核子反應器產生 3400 MW 的熱輸出，其爐心溫差(ΔT)為 60°F、質量流率為 1.1 x 10^8 lbm/hr。如果爐心 ΔT 為 63.6°F，爐心旁通流率為多少？(假設旁通水流 ΔT 等於 0°F)

A. 5.66 x 10^6 lbm/hr

B. 6.23 x 10^6 lbm/hr

C. 5.66 x 10^7 lbm/hr

D. 6.23 x 10^7 lbm/hr

答案：B.

科目： 193008
知能類：K1.20 [2.9/2.9]
序號： P590

Adequate core bypass flow is needed to...

A. cool the excore nuclear instrument detectors.

B. provide reactor coolant pump minimum flow requirements.

C. prevent stratification of reactor coolant inside the reactor vessel.

D. equalize the temperatures between the reactor vessel and the upper vessel head.

ANSWER: D.

爐心需要充分的旁通流，以……

A. 冷卻爐外的核能儀器偵測器。

B. 提供最低的反應器冷卻水泵流量。

C. 防止反應爐內的反應器冷卻水分層(stratification)。

D. 均衡反應爐槽與其上部槽頂的溫度。

答案：D.

科目： 193008
知能類：K1.20 [2.9/2.9]
序號： P1391

Which one of the following describes a function of core bypass flow?

A. Prevents excessive reactor vessel wall differential temperature

B. Prevents boron precipitation in the core baffle area

C. Provides a means of measuring core flow

D. Provides cooling to various reactor vessel internal components

ANSWER: D.

下列何者說明了爐心旁通流的功能？

A. 避免反應爐壁溫差過大。

B. 避免硼沈澱在爐心調節區(baffle area)。

C. 用來量測爐心流量。

D. 用來冷卻各種反應爐內部組件。

答案：D.

科目： 193008
知能類：K1.20 [2.9/2.9]
序號： P1488

Which one of the following is a function of core bypass flow?

A. Provides even flow distribution through the fuel.

B. Provides mixing of water in the reactor vessel head.

C. Ensures that core exit thermocouple readings represent average fuel temperatures.

D. Ensures that natural circulation will be initiated when forced circulation is lost.

ANSWER: B.

下列何者為爐心旁通流的功能？

A. 讓水流均勻流過燃料。

B. 用來混合反應爐頂部的水。

C. 確保爐心出口熱電偶讀數等於燃料平均溫度。

D. 確保失去強制循環時，能啟動自然循環。

答案：B.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P91

Maximizing the elevation difference between the core thermal center and the steam generator thermal centers and minimizing flow restrictions in the reactor coolant system (RCS) piping are plant designs to...

A. minimize the RCS volume.

B. maximize the RCS flow rate during forced circulation.

C. ensure a maximum RCS loop transit time.

D. ensure RCS natural circulation flow can be established.

ANSWER: D.

電廠設計將爐心與蒸汽產生器的熱中心高度差異增至最大，並將反應器冷卻水系統(RCS)管路的流動阻力降至最小，其用意是……

A. 將 RCS 體積減至最小。

B. 將強制循環時的 RCS 流率增至最大。

C. 確保 RCS 迴路流通時間(transit time)最長。

D. 確保 RCS 能建立自然循環水流。

答案：D.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P292

Which one of the following must exist for natural circulation flow to occur?

A. The heat source must be larger than the heat sink.

B. The heat source must be located higher than the heat sink.

C. The heat sink must be larger than the heat source.

D. The heat sink must be located higher than the heat source.

ANSWER: D.

欲讓自然循環水流產生，下列何者為必備條件？

A. 熱源(heat source)必須大於熱沈(heat sink)。

B. 熱源所在位置必須高於熱沈。

C. 熱沈必須大於熱源。

D. 熱沈位置必須高於熱源。

答案：D.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P893

The driving head for natural circulation flow through the core is developed by differences in _____ between the hot leg and the cold leg.

A. water density

B. water volume

C. pipe diameter

D. piping length

ANSWER: A.

通過爐心的自然循環水流驅動水頭，源自熱端與冷端的_____差異。

A. 水密度

B. 水體積

C. 管徑

D. 管長

答案：A.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P1387

If the steam generator thermal centers were at the same elevation as the reactor core thermal center, natural circulation flow in the reactor coolant system would...

A. not occur.

B. not be affected.

C. be greater than if they were at different elevations.

D. flow in the reverse direction.

ANSWER: A.

如果蒸汽產生器的熱中心高度與反應器爐心的熱中心相同，則反應器冷卻水系統的自然循環水流……

A. 不會發生

B. 不受影響

C. 大於高度不同時的水流

D. 逆向流動

答案：A.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P1393

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Stable natural circulation mass flow rate is 1,000 gpm.

When decay heat generation decreases to 0.5% rated thermal power, stable natural circulation flow rate will be approximately...

A. 125 gpm.

B. 250 gpm.

C. 707 gpm.

D. 794 gpm.

ANSWER: D.

一部核子反應器停機，並以自然循環冷卻爐心。產生衰變熱等於 1.0%額定熱功率。穩定自然循環質量流率為 1,000 gpm。

產生的衰變熱若降至 0.5%額定熱功率，穩定自然循環流率約為多少？

A. 125 gpm

B. 250 gpm

C. 707 gpm

D. 794 gpm

答案：D.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P1692

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Core ΔT has stabilized at 16°F.

When decay heat generation decreases to 0.5% rated thermal power, core ΔT will be approximately...

A. 2°F.

B. 4°F.

C. 8°F.

D. 10°F.

ANSWER: D.

一部核子反應器停機，並以自然循環冷卻爐心。產生衰變熱等於 1.0%額定熱功率。爐心 ΔT 穩定於 16°F。

產生衰變熱若減至 0.5%額定熱功率，爐心 ΔT 約為多少？

A. 2°F

B. 4°F

C. 8°F

D. 10°F

答案：D.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P1887

Establishing natural circulation requires that a heat sink be _____ in elevation than a heat source and that a _____ difference exist between the heat sink and heat source.

A. lower; pressure

B. lower; temperature

C. higher; pressure

D. higher; temperature

ANSWER: D.

建立自然循環需要熱沈(heat sink)高度_____熱源，而且熱沈與熱源之間存有_____。

A. 低於；壓差

B. 低於；溫差

C. 高於；壓差

D. 高於；溫差

答案：D.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P1989 (B2386)

Which one of the following conditions must occur to sustain natural circulation in a fluid system?

A. Subcooling of the fluid

B. A phase change in the fluid

C. A density change in the fluid

D. Radiative heat transfer to the fluid

ANSWER: C.

為了維持流體系統的自然循環，下列何者為必備條件？

A. 流體次冷

B. 流體相態改變(phase change)

C. 流體密度改變

D. 輻射傳熱至流體

答案：C.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P2092

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Core ΔT has stabilized at 16°F.

When decay heat generation decreases to 0.333% rated thermal power, core ΔT will be approximately...

A. 2°F.

B. 4°F.

C. 8°F.

D. 10°F.

ANSWER: C.

一部核子反應器停機，並以自然循環冷卻爐心。產生衰變熱等於 1.0%額定熱功率。爐心 ΔT 穩定於 16°F。

產生衰變熱若減至 0.333%額定熱功率，爐心 ΔT 約為多少？

A. 2°F

B. 4°F

C. 8°F

D. 10°F

答案：C.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P2392

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Core ΔT has stabilized at 13°F.

When decay heat generation decreases to 0.5% rated thermal power, core ΔT will be approximately...

A. 4°F.

B. 6°F.

C. 8°F.

D. 10°F.

ANSWER: C.

一部核子反應器停機，並以自然循環冷卻爐心。產生衰變熱等於 1.0%額定熱功率。爐心 ΔT 穩定於 13°F。

產生衰變熱若減至 0.5%額定熱功率，爐心 ΔT 約為多少？

A. 4°F

B. 6°F

C. 8°F

D. 10°F

答案：C.

科目： 193008
知能類：K1.21 [3.9/4.2]
序號： P2491

A nuclear reactor is shut down with natural circulation core cooling. Decay heat generation is equivalent to 1.0% rated thermal power. Stable natural circulation flow rate is 800 gpm.

When decay heat generation decreases to 0.5% rated thermal power, stable natural circulation flow rate will be approximately...

A. 400 gpm.

B. 565 gpm.

C. 635 gpm.

D. 696 gpm.

ANSWER: C.

一部核子反應器停機，並以自然循環冷卻爐心。產生衰變熱等於 1.0%額定熱功率。穩定自然循環質量流率為 800 gpm。

產生衰變熱若降至 0.5%額定熱功率，穩定自然循環流率約為多少？

A. 400 gpm

B. 565 gpm

C. 635 gpm

D. 696 gpm

答案：C.

科目： 193008
知能類：K1.22 [4.2/4.2]
序號： P1492

A nuclear power plant is operating at 100% power when a loss of offsite power occurs, resulting in a reactor trip and a loss of forced reactor coolant circulation. After 30 minutes, reactor coolant system (RCS) hot leg temperature is greater than cold leg temperature and steam generator (S/G) levels are stable.

Which one of the following combinations of parameter trends, occurring 30 minutes after the trip, indicates that natural circulation is occurring? (CET = core exit thermocouple)

	RCS HOT LEG TEMPERATURE	RCS COLD LEG TEMPERATURE	S/G PRESSURES	RCS CET SUBCOOLING
A.	Decreasing	Stable	Stable	Increasing
B.	Increasing	Decreasing	Increasing	Decreasing
C.	Decreasing	Decreasing	Decreasing	Decreasing
D.	Increasing	Increasing	Decreasing	Increasing

ANSWER: A.

核能電廠以 100%功率運轉，此時外電喪失而導致反應器急停，並失去反應器冷卻水強制循環。30 分鐘後，反應器冷卻水系統(RCS)的熱端溫度高於冷端，蒸汽產生器(S/G)水位穩定。

急停 30 分鐘後,下列那項參數組合傾向於指出發生自然循環？(CET = 爐心出口熱電偶)

	RCS 熱端溫度	RCS 冷端溫度	S/G 壓力	RCS CET 次冷度
A.	下降中	穩定	穩定	增加中
B.	升高中	下降中	增加中	減少中
C.	下降中	下降中	減少中	減少中
D.	升高中	升高中	減少中	增加中

答案：A.

科目： 193008
知能類：K1.22 [4.2/4.2]
序號： P1791

A nuclear reactor is operating at 100% power when a loss of offsite power occurs, resulting in a reactor trip and a loss of forced reactor coolant circulation. Reactor coolant system (RCS) hot leg temperature is greater than cold leg temperature and all other parameters (e.g. steam generator (S/G) levels) are stable.

Which one of the following combinations of parameter trends, occurring 2 hours after the trip, indicates that natural circulation is not occurring? (CET = core exit thermocouples)

	RCS HOT LEG TEMPERATURE	RCS COLD LEG TEMPERATURE	S/G PRESSURES	RCS CET SUBCOOLING
A.	Stable	Stable	Decreasing	Decreasing
B.	Stable	Decreasing	Decreasing	Stable
C.	Decreasing	Decreasing	Decreasing	Increasing
D.	Decreasing	Stable	Stable	Increasing

ANSWER: A.

核能電廠以 100%功率運轉，此時外電喪失而導致反應器急停，並失去反應器冷卻水強制循環。30 分鐘後，反應器冷卻水系統(RCS)的熱端溫度高於冷端，其他參數如蒸汽產生器(S/G)水位全部穩定。

急停 2 小時後，下列那項參數組合傾向於指出沒有發生自然循環？(CET = 爐心出口熱電偶)

	RCS 熱端溫度	RCS 冷端溫度	S/G 壓力	RCS CET 次冷度
A.	穩定	穩定	減少中	減少中
B.	穩定	下降中	減少中	穩定
C.	下降中	下降中	減少中	增加中
D.	下降中	穩定	穩定	增加中

答案：A.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P92

A nuclear reactor is shut down at normal operating temperature and pressure with all reactor coolant pumps stopped. Stable natural circulation cooling is in progress with 50°F of RCS subcooling. Which one of the following, if increased, will not affect natural circulation flow rate?

A. Reactor coolant pressure

B. Time after reactor trip

C. Feed water flow rate

D. Steam generator pressure

ANSWER: A.

一部核子反應器於正常運轉溫度及壓力下停機，所有反應器冷卻水泵停止運轉。在 RCS 次冷度為 50°F 下，進行穩定自然循環降溫。若下列何者增加，不會影響到自然循環流量？

A. 反應器冷卻水壓力

B. 反應器急停後歷經時間

C. 飼水流率

D. 蒸汽產生器壓力

答案：A.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P293

Fully-developed natural circulation flow rate will be greatest when...

A. all reactor coolant pumps stop sequentially within 1 hour after a reactor trip.

B. all reactor coolant pumps stop at the same time the reactor trips.

C. all reactor coolant pumps run for 1 hour after a reactor trip, and then stop.

D. only one reactor coolant pump runs for 1 hour after a reactor trip, and then stops.

ANSWER: B.

完全形成(fully-developed)的自然循環流率，將於何時最大？

A. 所有反應器冷卻水泵均於反應器急停後 1 小時內停止。

B. 所有反應器冷卻水泵同時於反應器急停時停止。

C. 所有反應器冷卻水泵於反應器急停後運轉 1 小時，然後停止。

D. 僅有一個反應器冷卻水泵於反應器急停後運轉 1 小時，然後停止。

答案：B.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P392

Natural circulation flow can be enhanced by...

A. increasing the elevation of the heat source to equal that of the heat sink.

B. increasing the temperature difference between the heat sink and the heat source.

C. decreasing the temperature difference between the heat sink and the heat source.

D. decreasing the elevation difference between the heat source and the heat sink.

ANSWER: B.

自然循環流量能透過下列何者加強？

A. 增加熱源高度(elevation)以與熱沈高度相同。

B. 增加熱沈與熱源之間的溫差。

C. 減少熱沈與熱源之間的溫差。

D. 減少熱源與熱沈之間的高度差。

答案：B.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P1493

Which one of the following will enhance natural circulation flow in the reactor coolant system?

A. Pressurizer level decreases.

B. Steam generator level increases.

C. Pressurizer pressure decreases.

D. Steam generator pressure increases.

ANSWER: B.

下列何者將增加反應器冷卻水系統內的自然循環流量？

A. 調壓槽水位降低。

B. 蒸汽產生器水位增加。

C. 調壓槽壓力降低。

D. 蒸汽產生器壓力增加。

答案：B.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P1591

A nuclear reactor had been operating at a constant power level for the last two weeks when a loss of all ac power occurred, thereby causing a scram and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the scram.

Which one of the following combinations of initial reactor power and post-scram steam generator pressure will result in the highest stable natural circulation flow rate 30 minutes after the scram?

	INITIAL REACTOR POWER	POST-SCRAM STEAM GENERATOR PRESSURE
A.	100%	1,100 psia
B.	25%	1,100 psia
C.	100%	1,000 psia
D.	25%	1,000 psia

ANSWER: C.

一部核子反應器已經以固定功率運轉兩週，此時因為喪失所有交流電力而急停，並失去反應器冷卻水強迫流量。急停 30 分鐘後，反應器形成自然循環冷卻水流並穩定。

在上述情形中，下列那組反應器初始功率和蒸汽產生器急停後壓力，將產生最高的穩定自然循環流率？

	反應器初始功率	蒸汽產生器急停後壓力
A.	100%	1,100 psia
B.	25%	1,100 psia
C.	100%	1,000 psia
D.	25%	1,000 psia

答案：C.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P1985

A nuclear reactor had been operating at a constant power level for the last two weeks when a loss of all ac power occurred, thereby causing a reactor trip and a loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized 30 minutes after the trip.

Which one of the following combinations of initial reactor power and post-trip steam generator pressure will result in the lowest stable natural circulation flow rate 30 minutes after the trip? (Assume constant steam generator water levels.)

	INITIAL REACTOR POWER	POST-TRIP STEAM GENERATOR PRESSURE
A.	100%	1,100 psia
B.	25%	1,100 psia
C.	100%	1,000 psia
D.	25%	1,000 psia

ANSWER: B.

一部核子反應器已經以固定功率運轉兩週，此時因為喪失所有交流電力而急停，並失去反應器冷卻水強迫流量。急停 30 分鐘後，反應器形成自然循環冷卻水流並穩定。

在上述情況中，下列那組反應器初始功率和蒸汽產生器急停後壓力，產生最低的穩定自然循環流率？(假設蒸汽產生器的水位維持不變)

	反應器初始功率	蒸汽產生器急停後壓力
A.	100%	1,100 psia
B.	25%	1,100 psia
C.	100%	1,000 psia
D.	25%	1,000 psia

答案：B.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P2492

A nuclear reactor had been operating at steady state 100% power when a loss of offsite power occurred, thereby causing a reactor trip and a complete loss of forced reactor coolant flow. Natural circulation reactor coolant flow developed and stabilized approximately 30 minutes after the trip.

Which one of the following combinations of reactor power history and post-trip steam generator pressure will result in the highest stable natural circulation flow rate?

	DAYS AT FULL POWER	POST-TRIP STEAM GENERATOR PRESSURE
A.	12	1,100 psia
B.	100	1,100 psia
C.	12	1,000 psia
D.	100	1,000 psia

ANSWER: D.

一部核子反應器以 100%穩態功率運轉，此時喪失外電而急停，反應器冷卻水強迫流量完全消失。大約急停 30 分鐘後，反應器形成自然循環冷卻水流並穩定。

下列那組反應器過去功率和蒸汽產生器急停後壓力，將產生最高的穩定自然循環流率？

	反應器全功率運轉天數	蒸汽產生器急停後壓力
A.	12	1,100 psia
B.	100	1,100 psia
C.	12	1,000 psia
D.	100	1,000 psia

答案：D.

科目： 193008
知能類：K1.23 [3.9/4.1]
序號： P3292

A few minutes ago, a nuclear power plant experienced a loss of offsite power that caused a reactor trip and a loss of all reactor coolant pumps. Natural circulation flow is currently developing in the reactor coolant system (RCS).

Which one of the following operator actions will enhance RCS natural circulation flow rate?

A. Establish and maintain saturation conditions in the RCS.

B. Establish and maintain a steam bubble in the reactor vessel.

C. Establish and maintain steam generator pressure above RCS pressure.

D. Establish and maintain steam generator water level high in the normal operating range.

ANSWER: D.

核能電廠於幾分鐘前喪失外電，造成反應器急停、所有反應器冷卻水泵停止運轉。反應器冷卻水系統(RCS)如今正形成自然循環水流。

運轉員採取下列那項動作時，將增加 RCS 的自然循環流率？

A. 在 RCS 建立並維持飽和狀態。

B. 在反應爐產生並維持汽泡。

C. 建立並維持高於 RCS 壓力的蒸汽產生器壓力。

D. 建立並維持蒸汽產生器水位高度到正常運轉的範圍。

答案：D.

科目： 193008
知能類：K1.24 [2.7/3.1]
序號： P592

During the reflux boiling method of core cooling, the steam that is generated in the core is condensed in the _____ side of a steam generator and flows back into the core via the _____. (Assume the steam generators contain U-tubes.)

A. hot leg; hot leg

B. cold leg; hot leg

C. hot leg; cold leg

D. cold leg; cold leg

ANSWER: A.

利用回流沸騰法(reflux boiling)冷卻爐心時，爐心產生的蒸汽於蒸汽產生器的_____側凝結，並經由_____回流至爐心(假設蒸汽產生器含 U 形管)

A. 熱端；熱端

B. 冷端；熱端

C. 熱端；冷端

D. 冷端；冷端

答案：A.

科目： 193008
知能類：K1.24 [2.7/3.1]
序號： P786

Which one of the following describes the mechanism for core heat removal during reflux cooling?

A. Forced coolant flow

B. Natural circulation coolant flow

C. Conduction with stagnant coolant flow

D. Radiation with total core voiding

ANSWER: B.

下列何者描述了爐心在回流冷卻(reflux cooling)時的移熱機制？

A. 強制冷卻水流。

B. 自然循環冷卻水流。

C. 利用停滯冷卻水流進行傳導。

D. 利用總爐心空泡(total core voiding)進行輻射。

答案：B.

科目： 193008
知能類：K1.24 [2.7/3.1]
序號： P2692

A nuclear power plant is experiencing natural circulation core cooling following a loss of coolant accident. Which one of the following, when it first occurs, marks the beginning of reflux core cooling? (Assume the steam generators contain U-tubes.)

A. Reactor core steam production results in two-phase coolant entering the hot leg and being delivered to the steam generators.

B. Hot leg steam quality is so high that the steam generators cannot fully condense it and two-phase coolant is returned to the reactor vessel via the cold leg.

C. Hot leg condensation is unable to pass completely through the steam generators to enter the cold legs.

D. The steam generators are no longer able to condense any of the steam contained in the hot leg.

ANSWER: C.

核能電廠發生冷卻水流失事故後，進行自然循環爐心冷卻。下列何者在首度發生時，代表爐心開始回流冷卻(reflux cooling)？(假設蒸汽產生器含 U 形管)

A. 反應器爐心產生蒸汽，造成雙相冷卻水進入熱端，並傳送至蒸汽產生器。

B. 熱端蒸汽乾度甚高，導致蒸汽產生器無法讓其全數凝結，雙相冷卻水於是經由冷端回流至反應爐。

C. 熱端凝結水無法全數通過蒸汽產生器以進入冷端。

D. 蒸汽產生器再也無法讓熱端內的蒸汽凝結。

答案：C.

科目： 193008
知能類：K1.25 [3.3/3.4]
序號： P593

A reactor coolant system cooldown is in progress on natural circulation via the steam generator (S/G) atmospheric steam relief valves (operated in manual control). If high point voiding interrupts natural circulation, which one of the following will occur? (Assume feed flow rate, relief valve position, and decay heat level are constant.)

A. S/G level increases and S/G pressure increases.

B. S/G level increases and S/G pressure decreases.

C. S/G level decreases and S/G pressure increases.

D. S/G level decreases and S/G pressure decreases.

ANSWER: B.

反應器冷卻水系統經由蒸汽產生器(S/G)大氣蒸汽釋壓閥(手動操作)，開始進行自然循環冷卻。如果自然循環因高處產生空泡而中斷，將發生什麼狀況？(假設飼水流量、釋壓閥位及衰變熱大小維持不變)

A. S/G 水位與壓力都增加。

B. S/G 水位增加、壓力降低。

C. S/G 水位降低、壓力增加。

D. S/G 水位與壓力都降低。

答案：B.

科目： 193008
知能類：K1.25 [3.3/3.4]
序號： P793

A reactor coolant system natural circulation cooldown is in progress via the steam generator (SG) atmospheric steam relief valves (operated in manual control). Assume feed flow rate, relief valve position, and decay heat level are constant.

If high point voiding interrupts natural circulation, SG levels will gradually _____; and core exit thermocouple indications will gradually _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

ANSWER: C.

反應器冷卻水系統經由蒸汽產生器(SG)大氣蒸汽釋壓閥(手動操作)，開始進行自然循環冷卻。假設飼水流率、釋壓閥位及衰變熱大小維持不變。

如果自然循環因高處產生空泡而中斷，SG 水位將逐漸_____；爐心出口熱電偶指示值將逐漸_____。

A. 降低；增加

B. 降低；降低

C. 增加；增加

D. 增加；降低

答案：C.

科目： 193008
知能類：K1.25 [3.3/3.4]
序號： P2093

A reactor coolant system natural circulation cooldown is in progress via the steam generator (S/G) atmospheric steam relief valves (operated in manual control).

If high point voiding interrupts natural circulation, which one of the following will occur? (Assume feed flow rate, relief valve position, and decay heat level are constant.)

A. S/G pressure decreases and core exit thermocouple (CETC) temperature increases.

B. S/G pressure decreases and CETC temperature remains constant.

C. S/G pressure increases and CETC temperature increases.

D. S/G pressure increases and CETC temperature remains constant.

ANSWER: A.

反應器冷卻水系統經由蒸汽產生器(S/G)大氣蒸汽釋壓閥(手動操作)，開始進行自然循環冷卻。

如果自然循環因高處產生空泡而中斷，將發生什麼狀況？(假設飼水流量、釋壓閥位及衰變熱大小維持不變)

A. S/G 壓力降低、爐心出口熱電偶(CETC)溫度升高。

B. S/G 壓力降低、CETC 溫度維持不變。

C. S/G 壓力增加、CETE 溫度升高。

D. S/G 壓力增加、CETC 溫度維持不變。

答案：A.

科目： 193008
知能類：K1.25 [3.3/3.4]
序號： P2493

A reactor coolant system natural circulation cooldown is in progress via the steam generator (S/G) atmospheric steam relief valves (operated in manual control).

If S/G high point voiding interrupts natural circulation, which one of the following will occur? (Assume feed flow rate, relief valve position, and decay heat level are constant.)

A. S/G steam flow rate decreases and core exit thermocouple (CETC) temperature increases.

B. S/G steam flow rate decreases and CETC temperature remains constant.

C. S/G steam flow rate increases and CETC temperature increases.

D. S/G steam flow rate increases and CETC temperature remains constant.

ANSWER: A.

反應器冷卻水系統經由蒸汽產生器(S/G)大氣蒸汽釋壓閥(手動操作)，開始進行自然循環冷卻。

如果自然循環因蒸汽產生器高處產生空泡而中斷，將發生什麼狀況？(假設飼水流率、釋壓閥位及衰變熱大小維持不變)

A. S/G 蒸汽流率減少、爐心出口熱電偶(CETC)溫度升高。

B. S/G 蒸汽流率減少、CETC 溫度維持不變。

C. S/G 蒸汽流率增加、CETE 溫度升高。

D. S/G 蒸汽流率增加、CETC 溫度維持不變。

答案：A.

科目/題號：193008/1 (2016新增)
知能類： K1.02 [2.8/3.0]
序號： P5745 (B5744)

Initially, subcooled water is flowing into a fuel assembly with subcooled water exiting the fuel assembly several degrees hotter than when it entered. No boiling is occurring in the fuel assembly. Assume that fuel assembly thermal power and water flow rate remain the same.
System pressure is decreased, causing some of the water in contact with the fuel rods to boil during transit through the fuel assembly, but the water exiting the fuel assembly remains subcooled. Compared to the initial conditions, the average fuel temperature in the fuel assembly will be _____; and the temperature of the water exiting the fuel assembly will be _____.
A. higher; the same
B. higher; higher
C. lower; the same
D. lower; higher
ANSWER: D.

起初次冷水流進燃料束，但流出燃料束時比流進時溫度高數度。燃料束無沸騰產生。假設燃料束之熱功率和水流量維持固定。系統壓力降低，引起某些與燃料棒接觸的水流，當流經燃料束時沸騰，但從燃料束流出之水流仍舊是次冷狀態。與起初條件相比較，燃料束之平均燃料溫度將會_____；且流經燃料束之水流溫度將會_____。
A.較高；相同
B.較高；較高
C.較低；相同
D.較低；較高

答案： D

科目/題號：193008/2 (2016新增)
知能類：K1.04 [3.1/3.3]
序號：P287 (B2987)

Which one of the following describes the heat transfer from a fuel rod experiencing departure from nucleate boiling? (ΔT refers to the difference between the fuel rod surface temperature and the coolant saturation temperature.)

A. Steam bubbles begin to blanket the fuel rod surface, causing a rapid increase in the ΔT for a given heat flux.
B. Steam bubbles completely blanket the fuel rod surface, causing a rapid decrease in the ΔT for a given heat flux.
C. Steam bubbles begin to form on the fuel rod surface, causing a rapid increase in the heat flux from the fuel rod for a given ΔT.
D. Steam bubbles completely blanket the fuel rod surface, causing a rapid increase in the heat flux from the fuel rod for a given ΔT.

ANSWER: A.

若燃料棒與冷卻水間的溫差為ΔT，下列何者描述了燃料棒在偏離核沸騰時的熱傳？

A.汽泡開始覆蓋燃料棒護套，導致ΔT快速增加(當熱通量固定時)

B.汽泡完全覆蓋燃料棒護套，導致ΔT快速減小(當熱通量固定時)

C.汽泡開始在燃料棒護套上形成，導致燃料棒的熱通量快速減小(當ΔT固定時)

D.汽泡完全覆蓋燃料棒護套，導致燃料棒的熱通量快速增加(當ΔT固定時)

答案：A

科目/題號：193008/3 (2016新增)
知能類：K1.18 [2.3/2.5]
序號：P5446 (B5445)

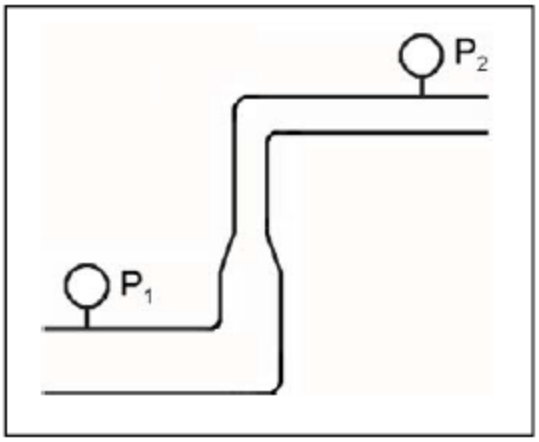
Refer to the drawing of a section of pipe that contains flowing subcooled water (see figure below).
Given:
- Pressure at P1 is 24 psig.
- Pressure at P2 is 16 psig.
- Pressure change due to change in velocity is 2 psig.
- Pressure change due to change in elevation is 10 psig.

The pressure decrease due to friction head loss between P1 and P2 is _____; and the direction of flow is from _____.
A. 2 psig; left to right
B. 2 psig; right to left
C. 4 psig; left to right
D. 4 psig; right to left
ANSWER: D.

參考一段內含有流動的次冷水管路圖(見下圖)
已知：
- 在 P_1 處的壓力為 24 psig
- 在 P_2 處的壓力為 16 psig
- 因速度變化造成的壓力變化為 2 psig
- 因高程變化造成的壓力變化為 10 psig

在P_1和P_2之間由於摩擦水頭損失造成壓力減少是_____；而流動方向是從_____。
A. 2 psig；左至右
B. 2 psig；右至左
C. 4 psig；左至右
D. 4 psig；右至左

答案： D



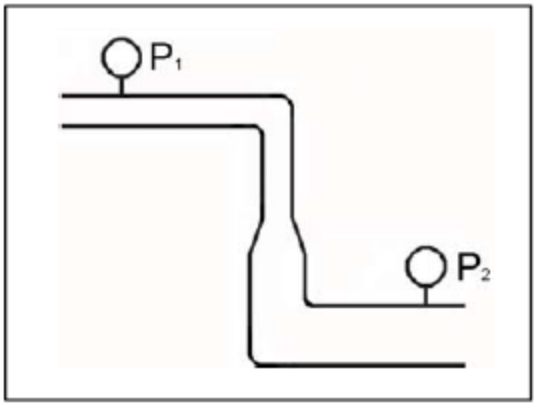
科目/題號：193008/4 (2016新增)
知能類：K1.18 [2.3/2.5]
序號：P5847 (B5845)

Refer to the drawing of a section of pipe that contains flowing subcooled water (see figure below).
Given:
- Pressure at P1 is 26 psig.
- Pressure at P2 is 34 psig.
- Pressure change due to change in velocity is 2 psig.
- Pressure change due to change in elevation is 8 psig.

The pressure decrease due to friction head loss between P1 and P2 is _____; and the direction of flow is from _____.
A. 2 psig; left to right
B. 2 psig; right to left
C. 4 psig; left to right
D. 4 psig; right to left
ANSWER: A.

參考一段內含有流動的次冷水管路圖(見下圖)
已知：
- 在 P_1 處的壓力為 26 psig
- 在 P_2 處的壓力為 34 psig
- 因速度變化造成的壓差為 2 psig
- 因高程變化造成的壓差是8 psig

在P_1和P_2之間由於摩擦水頭損失造成壓力減少是_____；而流動方向是從_____。
A. 2 psig；左至右
B. 2 psig；右至左
C. 4 psig；左至右
D. 4 psig；右至左
答案： A



科目/題號：193008/5 (2016新增)
知能類：K1.18 [2.3/2.5]
序號：P6648 (B6646)

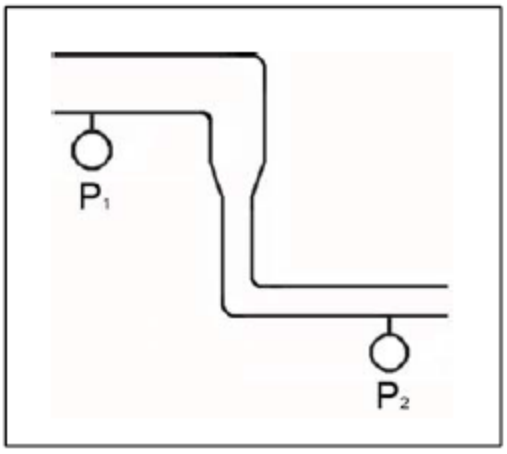
Refer to the drawing of a section of pipe that contains flowing subcooled water. (See figure below).
Given:
- Pressure at P1 is 30 psig.
- Pressure at P2 is 32 psig.
- Pressure change due to change in velocity is 2 psig.
- Pressure change due to change in elevation is 2 psig.

The pressure decrease due to friction head loss between P1 and P2 is _____; and the direction of flow is from _____.
A. 2 psig; left to right
B. 2 psig; right to left
C. 6 psig; left to right
D. 6 psig; right to left
ANSWER: B.

參考一段內含有流動的次冷水管路圖(見下圖)
已知：
- 在 P_1 處的壓力為 30 psig
- 在 P_2 處的壓力為 32 psig
- 因速度變化造成的壓差為 2 psig
- 因高程變化造成的壓差為 2 psig

在P_1和P_2之間由於摩擦水頭損失造成壓力減少是_____；而流動方向是從_____。
A. 2 psig；左至右
B. 2 psig；右至左
C. 6 psig；左至右
D. 6 psig；右至左

答案： B



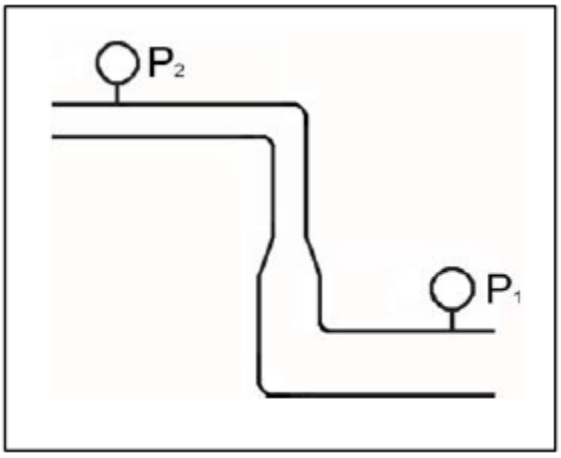
科目/題號：193008/6 (2016 新增)
知能類： K1.18 [2.3/2.5]
序號： P7048 (B7046)

Refer to the drawing of a section of pipe that contains flowing subcooled water (see figure below).
Given:
- Pressure at P1 is 34 psig.
- Pressure at P2 is 20 psig.
- Pressure change due to change in velocity is 2 psig.
- Pressure change due to change in elevation is 8 psig.

The pressure decrease due to friction head loss between P1 and P2 is _____; and the direction of flow is from _____.
A. 2 psig; left to right
B. 2 psig; right to left
C. 4 psig; left to right
D. 4 psig; right to left
ANSWER: D.

參考一段內含有流動的次冷水管路圖(見下圖)
已知：
- 在 P_1 處的壓力為 34 psig
- 在 P_2 處的壓力為 20 psig
- 因速度變化造成的壓力變化是 2 psig
- 因高程變化造成的壓力變化是 8 psig

在P_1和P_2之間由於摩擦水頭損失造成壓力減少是_____；而流動方向是從_____。
A. 2 psig；左至右
B. 2 psig；右至左
C. 4 psig；左至右
D. 4 psig；右至左
答案： D



科目/題號：193008/7 (2016 新增)
知能類：K1.21 [3.9/4.2]
序號：P7447

Sustained natural circulation requires that the heat source is _____ in elevation than the heat sink; and that there is a _____ difference between the heat source and the heat sink.
A. lower; phase
B. lower; temperature
C. higher; phase
D. higher; temperature
ANSWER: B.

維續自然循環需要熱源高程比熱沉_____；且熱源與熱沉之間有_____差。
A.較低；相
B.較低；溫度
C.較高；相
D.較高；溫度

答案： B