U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No(s). 50-346/OL-84-01

Docket No(s). 50-345 License No(s). NPF-3

Licensee: Toledo Edison Company
300 Madison Avenue
Toledo, Ohio 45652

Facility Name: Davis Besse Nuclear Power Station

Examination Administered At: Davis Besse

Examination Conducted: December 18, 19, 1984

Examiner(s): W. J. Apley, PNL 1/14/85
Date

Approved By: J. I. McMillen, Chief 1/14/85
Operating License Section Date

Examination Summary

Examination administered onDecember 18, 19, 1984 (Report No(s).50-346/OL-84-01)

Results: Written exam was administered to one SRO upgrade on December 18. Two orals were administered on December 19 to one RO-Retake and one SRO upgrade. There were no failures.

REPORT DETAILS

1. Examiners

Walter J. Apley, PNL

2. Examination Review Meeting

At the conclusion of the SRO written examination, Walt Apley met with Edward Bergner and Richard A. Simpkins of Davis Besse to review the written examination and answer key.

6.17 Facility objected to this question, saying that it represented too fine a level of detail and that information on protective relays is readily available to the operator in the control room.

6.18 Missing line "any three but" added to answer key.

7.3 Answer key modified to allow 1/2 credit if answer states that it is a Tech Spec Requirement (did not affect grading).

7.7 Answer key modified to address actions if plant was tripped (need to break vacuum).

7.10 Answer key changed - 1500 ppmb to 18 ppmb. Procedure was revised since copy sent to examiner - same reference.

7.12 Throttling criteria modified in answer key. Procedure was revised since copy sent to examiner - same reference.

7.13 Controlling OTSG levels modified in answer key. Procedure was revised since copy sent to examiner - same references.

No questions were deleted, including 6.17, as it was felt by the examiner that the importance of that question, the extent of training provided by the facility in that area, and the approval review by Region III warranted retaining that question.

3. Exit Meeting

At the conclusion of the site visit (December 19) the examiner again met with Edward Bergner and Richard A. Simpkins. The two NRC resident inspectors were notified of the meeting time (Don Cossloff/Walt Rogers), but due to schedule conflicts related to the plant startup from a refueling shutdown were unable to attend the exit meeting. The fact that both candidates had clearly passed the oral examinations was stated at the meeting.

- MASTER -

U. S. NUCLEAR REGULATORY COMMISSION
SENIOR REACTOR OPERATOR LICENSE EXAMINATION

Facility: Davis Besse

Reactor Type: B&W

Date Administered: December 18, 1984

Examiner: Walter J. Apley

Candidate: _____

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheet. Points for each question are indicated in parenthesis after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up six (6) hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Cat. Value	Category
25	25			5. Theory of Nuclear Power Plant Operation, Fluids and Thermodynamics
25	25			6. Plant System Design, Control and Instrumentation
25	25			7. Procedures - Normal, Abnormal, Emergency, and Radiological Control
25	25			8. Administrative Procedures, Conditions, and Limitations
100				TOTALS
		Final Grade	%	

All work done on this examination is my own; I have neither given nor received aid.

Started Review: 12[52] PM
Completed Review: 2[44] PM

_____
Candidate's Signature

Walter J. Apley

Edward Berger
Edward Berger

Richard A. Simpkins
Richard A. Simpkins

5.0 THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS (25 Points)

5.1 In the letdown cooler, explain why component cooling water flow is established before primary water flow. (1.5)

5.2 The procedure for operating the DHR System (SP 1104.04.15) states that pump operation is limited by "NPSH" and "flow rate vortexing". Explain the difference between those two terms as they apply to pump operation. (2.0)

5.3 Answer the following relative to Davis Besse Cooling Tower Operation:

a. Why is the airflow/waterflow set up according to the counter flow principle? (1.0)

b. TRUE or FALSE: If there was no drift eliminator section, makeup to the tower would have to be increased. (0.5)

c. TRUE or FALSE: The draft necessary for tower operation is caused by wind flowing across the open top of the tower ("coke-bottle" effect). (0.5)

5.4 The initial WGDT pressure is 10 psig. How much would the pressure have to be increased by Nitrogen addition to reduce the Oxygen concentration from 2% to 1%. Show calculation. (1.5)

5.5 Why does Xenon peak later following a shutdown from high power than it does when following a shutdown from a low power level? (2.0)

5.6 What happens to the temperature of the steam leaving the OTSG as power is increased from 25 to 100%? Explain why the temperature behaves as it does. (2.0)

- Section 5 Continued on Next Page -

5.7 Gamma compensation isn't required in the power range for three (3) reasons. Which of the statements below is NOT one of those reasons?

a. Background (decay) gamma flux is insignificant in comparison to the neutron flux.

b. Fission gamma flux contributes approximately 1% of thermal power.

c. Power range instruments are calibrated to a heat balance.

d. Fission product decay gammas cause decay heat which can be approximately 5-7 percent of thermal power. (1.0)

5.8 Assume the ICS is in Automatic at 75% power. What % step load rejection could the plant handle without turbine bypass valve action / without code safety valve action? Select the best answer below.

a. 10% / 20%
b. 10% / 40%
c. 40% / 50%
d. 40% / 75% (0.5)

5.9 When a fuel assembly is loaded, one detector may show a sharp increase in count rate (and corresponding drop in 1/M) while the other detector(s) show no such drastic increase. Give (2) reasons that may warrant disregarding such a discrepancy and continuing with the fuel loading. (2.0)

5.10 The Plant Startup Procedure (PP 1102.02.15) notes that quadrant power tilt (QPT) values may be substantially higher than normal during a three RCP Startup due to large delta Tcold's. Would the most limiting values of QPT occur at low or high power? Explain your answer. (1.5)

5.11 a. What is the basis for limiting the rate of power increase to 10% per hour below 20% power? (1.0)

b. What is the basis for having two 5 hour holds at 75% and 90% power during startup? (1.0)

5.12 What is the major problem associated with conducting a natural circulation cooldown at greater than 1.5 degrees F/hr? (1.0)

- Section 5 Continued on Next Page -

5.13 What is the minimum time the reactor must be shutdown to allow the decay heat level to be low enough to be matched by MU/HPI cooling?

a. 1/2 hour
b. 1 hour
c. 4 hours
d. 12 hours
e. 24 hours (0.5)

5.14 The reactor is shut down by 6% delta K/K with a source neutron count rate indication of 50 CPS. Rods are withdrawn to raise the source range indication to 300 CPS. What is the value of reactivity when counts are 300 CPS? (2.0)

5.15 a. TRUE or FALSE: The power coefficient of reactivity is primarily influenced by the doppler coefficient. (0.5)

b. TRUE or FALSE: At normal operating pressure and temperature, 1% delta K/K is worth approximately 100 ppm boron. (0.5)

5.16 Technical Specifications describe power peaking limits (approximately 20.5 KW/ft), but state that the peaking is not a directly observable quantity. What limits are observed to prevent exceeding the power peaking restrictions? (1.0)

5.17 List three (3) out of the four (4) reasons why there is a minimum temperature for criticality (525 degrees F)? (1.5)

- END OF SECTION 5 -

6.0 PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION (25 Pts)

6.1 For the ICS system, explain why whenever the rod control panel is placed in HAND, the reactor demand station should also be placed in HAND. (1.0)

6.2 On a loss of CCW at normal RCS operating temperature, approximately how fast would the CRDM stator temperature increase? Select closest answer below.

a. 10 degrees F in 1/2 hour
b. 50 degrees F in 1/2 hour
c. 100 degrees F in 1/2 hour
d. 200 degrees F in 1/2 hour. (0.5)

6.3 Describe what happens to steam flow, normal feedwater flow, and auxiliary feedwater flow if:

a. One OTSG's pressure drops below 612 psig while the pressure in the other OTSG does not.

b. One OTSG's level drops below 26.5" indicated S/U range while the level in the other does not. (3.0)

6.4 If cooldown using AFP's is required for an extensive period such that CST water is exhausted, the automatic shift to Service Water should be verified or manually initiated if CST level falls below 3 feet. TRUE or FALSE: a manual initiation can be done from the Control Room using the Control Room switches. (0.5)

6.5 TRUE or FALSE: The capacity of the Startup Feedwater Pump is based on being able to provide sufficient feedwater to remove the maximum potential decay heat one hour after a reactor shutdown. (0.5)

6.6 If one condensate pump is capable of bringing station load up to 55% full power, what conditions would require that three (3) condensate pumps be in operation prior to going to full power? (1.5)

6.7 What component limits the speed with which a live transfer of MFPT's from the Main to Aux Steam System can be made? (1.0)

- Section 6 Continued on Next Page -

6.8 Match the initiating event (letter) with the resultant action (number).

a. Instrument air supply pressure decreases to 75 psig.

b. Turbine bypass valves H/A selector stations are in "Hand," and S/G exit pressure exceeds 1050 psig.

c. Loss of electrical signal (± 24 V DC) or a loss of power (118 VAC) to the turbine bypass valve electro-to-pneumatic (E/P) converter.

Facility will check — procedure says correct but reviewer wanted to check other references

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1. Turbine bypass valves open
2. Turbine bypass valves stay as-is
3. Turbine bypass valves close. (1.5)

6.9 If an undervoltage condition occurs on 4160 V bus C1, what will happen to the Makeup Pump #1 breaker during the automatic load shed? (1.0)

6.10 What happens if the diesel generator does not reach 200 RPM within 6 seconds of receiving a start signal? (1.0)

6.11 a. How would elevated containment temperature affect core flood tank level indication? (1.0)

b. List two (2) other level indicators whose accuracy would be affected by a significant increase (e.g. 100 degrees F) in containment temperature. (0.8)

6.12 Assume that a non-running CCW pump receives a simultaneous start and stop signal. Select which one of the following statements is FALSE:

a. The pump breaker will stay in the open position.

b. If the stop signal is cleared, breaker will close. (0.5)

6.13 Why is it important to maintain cooling air flow to the charcoal filters in the Emergency Ventilation System (EVS)? (1.0)

6.14 What four (4) conditions must exist for a Rapid Feedwater Reduction (RFR)? (2.0)

- Section 6 Continued on Next Page -

6.15 TRUE or FALSE: If an operator depresses the emergency stop button for a circulating water pump, the pump's discharge valve will close and 5-10 seconds later the pump will trip. (0.5)

6.16 Match the power supply (letter) with the load (number).

a. 4.16 KV SWGR BUS D1
b. 4.16 KV SWGR BUS D2
c. 4.16 KV SWGR BUS C1
d. 4.16 KV SWGR BUS C2

1. Condensate Pump #2
2. HPI Pump #1
3. 480 V SWGR BUS F1
4. Switchyard Feeder #1. (1.6)

6.17 Match the protective relay (letter) with the protective function (number) that it provides.

a. 27 Relay
b. 50 Relay
c. 63 Relay
d. 87 Relay

1. Sudden Pressure (liquid or gas)
2. Instantaneous Overcurrent or Rate-of-Rise
3. Differential Current
4. Undervoltage (1.6)

6.18 What three (3) emergency diesel generator trips are automatically bypassed on a loss of essential bus voltage or a LOCA? (1.5)

6.19 All equipment affected by SFAS have an amber SAM light/pushbutton located near the respective control switch in the Control Room. What does it mean when the SAM light is flashing? (1.0)

- Section 6 Continued on Next Page -

6.20 Which one of the following will NOT directly cause an ARTS trip?

a. Manual trip of the turbine-generator at 25% power

b. Loss of feedwater pressure on both steam generators

c. Trip of both MFPTs

d. A trip of any two SFRCS channels. (1.0)

6.21 TRUE or FALSE: SFAS initiation on high containment pressure, high containment radiation and from the manual actuation switches will function normally with the SFAS low RCS pressure trip BLOCKED. (1.0)

- END OF SECTION 6 -

7.0 PROCEDURES - NORMAL, ABNORMAL, EMERGENCY, AND RADIOLOGICAL CONTROL (25 Points)

7.1 During a main turbine startup, turbine supervisory instruments indicate an undesirable differential expansion (recorder indicating within the red bands) or vibration condition (800 rpm, 9 mils; 1500 rpm, 10 mils; 1800 rpm, 12 mils; maximums) serious enough to make a reduction in speed necessary. Should the operator trip the turbine or decelerate the unit to a lower speed and hold? (1.0)

7.2 Describe how to shift a Containment Air Cooling Fan from Fast to Slow speed. (1.0)

7.3 Why is the Control Room normal HVAC placed in the Recirculation Mode when either one chlorine detector or one station vent low range radiation monitor is out of service? (2.0)

7.4 By procedure, what are the minimum and maximum temperatures allowed in the BWST? (1.0)

7.5 TRUE or FALSE: If a BTU limit occurs while in manual control of feedwater demand, the operator should reduce reactor power until the BTU limiting condition just clears. (0.5)

7.6 By procedure the Reactor Coolant Chemistry parameters (letter) listed below are controlled within precise limits. Match the parameters (letter) with the reason for maintaining control (number).

a. pH
b. Hydrogen
c. Fluorine

_____
1. Suppress radiolytic decomposition of water
2. Preclude corrosion of Zr cladding
3. Preclude caustic stress corrosion (1.5)

7.7 On a loss of Instrument Air, how is condenser vacuum controlled? (1.5)

7.8 How are the main steam line radiation monitors operated to ensure early detection of OTSG tube leakage in ALL reactor modes? (2.0)

- Section 7 Continued on Next Page -

7.9 According to the Plant Shutdown and Cooldown Procedure (PP 1102.10.12) description of a normal shutdown, after all rods have been inserted (except group 8) the reactor is tripped. Why must the turbine bypass valves be in hand control when the reactor is tripped? (1.0)

7.10 What is the required operator action if on a reactor trip, two or more rods fail to insert? (1.5)

7.11 The SGTR Emergency Procedure (EP 1202.01) requires a manual reactor shutdown. At what pressurizer level must the reactor be tripped if that level is reached? (1.0)

7.12 Under what specific conditions, following a valid automatic initiation, may MU/HPI be throttled or terminated? (2.5)

7.13 Fill in the blanks regarding S/G level for the following statements:

a. If SFRCS has actuated and SA2 has NOT actuated, maintain operable SGs at ___?___ inches on the Startup Range using AFW. (1.0)

b. If SFRCS has actuated and SA2 has actuated, maintain operable SGs at ___?___ inches on the Startup Range using AFW. (1.0)

- Section 7 Continued on Next Page -

7.14 What special precautions must be taken in the situation where a fuel assembly is inserted in the core without being surrounded on all four sides (assume that a "low load" is received and that the Z-Z tape reading is correct)? (1.0)

7.15 An asymmetric fault runback is occurring at 3% per minute. Power is at 75%, automatically reducing to less than 60%. The RO reports that core imbalance is approaching the trip setpoint. What should be done? (2.0)

7.16 List three (3) precautions that must be taken when entering an "Extremely High Radiation Area?" (1.5)

7.17 TRUE or FALSE: According to Administrative Procedure AD 1827.08 (Flooding), full evacuation is NOT anticipated under any flood emergency conditions (flood watch, flood warning, and/or flood emergency). (0.5)

Question asked "site evacuation"; answer Yes

7.18 According to EP 1202.01 (Lack of Adequate Subcooling Margin), how does the operator verify that primary to secondary heat transfer is NOT excessive? (1.5)

- END OF SECTION 7 -

8.0 ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS (25 Points)

8.1 During a shutdown, repair work is being conducted on the main turbine and EHC system. Why would you want to avoid installing servo-valves in the EHC system at the same time that heat retention lagging is being cut and fitted in the same area? (2.0)

8.2 What is the minimum main generator load change that requires load dispatcher notification? Select one.

a. 10 MW
b. 25 MW
c. 50 MW
d. 100 MW (0.5)

8.3 In the event a bus, transformer, or generator lockout occurs, whose concurrence is needed prior to resetting the lockout and re-energizing the equipment (3 required for full credit)? (2.0)

8.4 What must be done if an operator notices that either of the Core Flood Tank levels has increased by more than 80 gallons (approximately 0.15 ft)? (1.0)

8.5 How often should the load on each station air compressor be switched to ensure even valve wear?

a. Once per shift
b. Once per day
c. Once per week
d. Once per month (0.5)

8.6 An SFAS actuation occurs. Plant conditions have stabilized at normal operating or hot standby conditions following the transient. What condition determines whose permission (Shift Supervisor or Station Superintendent) is needed prior to bypassing a safety system? (1.0)

8.7 What limitation determines the necessary amount of cooling water tower blowdown? (1.0)

8.8 a. A plant shutdown is initiated due to a Technical Specifications requirement. Within what minimum time period must the NRC be notified? (0.5)

b. Can this notification be made to the NRC resident inspector, or must it be made using the emergency telephone? (0.5)

- Section 8 Continued on Next Page -

8.9 The Davis Besse Station Operations Administrative Procedure (AD 1839.00) requires that one SRO will remain within the CTRM area at all times. What minimum percentage of that time is the SRO required to be in front of the CTRM panels? (1.0)

8.10 According to Davis Besse Special Orders (26-3), what are the two (2) actions that the second dedicated reactor operator required to remain in the control room must be available to perform? (2.0)

8.11 When reviewing P&IDs, what does the following valve indicators tell the operator about the normal position of that valve?

a.  (.25)

b.  (.25)

c.  (.25)

8.12 Which one (1) of the following Personnel Safety and Precaution Statements is NOT true regarding divers in the Refueling Canal, Transfer Canal, or Spent Fuel Canal?

a. Each diver will be equipped with an alarming dosimeter, with a remote readout detector when in the water.

b. Anytime a diver is in any canal or pool associated with refueling, 60% of all underwater lighting must be available for use.

c. If fuel is moved between dives, then a complete survey will be conducted of the work area and all areas the diver may travel through entering and leaving the water prior to the next dive.

d. There will be no fuel transfer in progress whenever a diver is in the Refueling Canal, Transfer Canal or Spent Fuel Pool. (1.0)

8.13 a. What is a Class B fire and what type of extinguisher is to be used on a Class B fire? (1.0)

b. What is a Class C fire and what type of extinguisher is to be used on a Class C fire. (1.0)

8.14 TRUE or FALSE: Radiation Exposure Permits are signed by the Shift Supervisor. (0.5)

- Section 8 Continued on Next Page -

8.15 What is the location and purpose of each of the following four (4) centers during an emergency event.

a. Operation Support Center
b. Site Emergency Operations Center
c. Technical Support Center
d. Emergency Control Center (2.0)

8.16 In August 1984 the Emergency Plan Implementing Procedure (EI 1300.00) was revised to change the emergency radiation exposure guideline to save a life from 100 Rem to what value? (1.0)

8.17 Who is responsible for the implementation of the Emergency Plan Recovery Procedure (EI 1300.11.2) if an Unusual Event was the highest level declared for the emergency? (1.0)

8.18 Within what maximum time period should the Emergency Duty Officer be available to respond to any problem on-site? (1.0)

8.19 List the six (6) operational modes defined in Technical Specifications including the limits of each for Keff, % Rated Thermal Power, and Average Coolant Temperature. (3.0)

8.20 If a surveillance requirement is to be performed on a weekly basis, what is the maximum number of days that can occur between performances and still maintain compliance with OPERABILITY requirements? (.75)

- END OF SECTION 8

- END OF EXAM -

EQUATION SHEET

Where $\dot{m}_1 = \dot{m}_2$

$(\text{density})_1(\text{velocity})_1(\text{area})_1 = (\text{density})_2(\text{velocity})_2(\text{area})_2$

$KE = \frac{mv^2}{2}$ $\quad PE = mgh$ $\quad PE_1+KE_1+P_1V_1 = PE_2+KE_2+P_2V_2$ $\quad$ where V = specific volume, P = Pressure

$Q = \dot{m}c_p(T_{out}-T_{in})$ $\quad Q = UA\,(T_{ave}-T_{stm})$ $\quad Q = \dot{m}(h_1-h_2)$

$P = P_0 10^{sur(t)}$ $\quad P = P_0 e^{t/T}$ $\quad SUR = \frac{26.06}{T}$

delta $K = (K_{eff}-1)/K_{eff}$ $\quad CR_1(1-K_{eff1}) = CR_2(1-K_{eff2})$

$M = \frac{(1-K_{eff1})}{(1-K_{eff2})}$ $\quad SDM = \frac{(1-K_{eff}) \times 100\%}{K_{eff}}$

decay constant $= \frac{\ln(2)}{t_{1/2}} = \frac{0.693}{t_{1/2}}$ $\quad A = A_0 e^{-(\text{decay constant})x(t)}$

Water Parameters

1 gallon = 8.345 lbs
1 gallon = 3.78 liters

1 ft^3 = 7.48 gallons

Density = 62.4 lbm/ft^3

Density = 1 gm/cm^3
Heat of Vaporization = 970 Btu/lbm
Heat of Fusion = 144 Btu/lbm
1 Atm = 14.7 psia = 29.9 in Hg

Miscellaneous Conversions

1 Curie = 3.7×10^{10} dps
1 kg = 2.21 lbs

1 hp = 2.54×10^3 Btu/hr

1 Mw = 3.41×10^6 Btu/hr

1 inch = 2.54 centimeters
Degrees F = (1.8) x (Degrees C) + 32
1 Btu = 778 ft-lbf
$g = 32.174$ ft-lbm/lbf-sec^2

-MASTER-

U. S. NUCLEAR REGULATORY COMMISSION
SENIOR REACTOR OPERATOR LICENSE EXAMINATION

Facility: Davis Besse

Reactor Type: B&W

Date Administered: December 18, 1984

Examiner: Walter J. Apley

Candidate: _____

INSTRUCTIONS TO CANDIDATE:

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25	25			8. Administrative Procedures, Conditions, and Limitations
100				TOTALS

Final Grade _____ %

ANSWER KEY

All work done on this examination is my own; I have neither given nor received aid.

_____
Candidate's Signature

Started Review: 12[52] PM
Completed Review: 2[44] PM

Walter J. Apley

Richard A. Simpkins

Edward Bergwor

5.0 THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS

5.1 To prevent water hammer forces on tubes and baffles

Ref: SP 1104.02.17, p. 8

5.2 NPSH is a sufficient level of water (or head) such that "steam" bubble formation does not occur with resultant cavitation in the low pressure impeller (eye) of the DHR pump.

Flow rate vortexing is an entrainment of air in the pumps suction due to the "Vee" formed as water is drained down into the pump, with resultant cavitation.

Ref: SP-1104.04.18, p. 22

5.3 a. A counterflow heat exchanger is more efficient since the cooler water contacts the cooler air initially.

b. True - Drift eliminator stops water being carried up with the draft.

c. False - Flow of air is caused by the density difference between the atmospheric air and that inside the tower which has been "warmed" by the hot water from the plant.

Ref: SP 1104.09.8, p. 3 / Lic. Info Manual, p. II-87

5.4 Initial pressure = 10 psig which is 25 psia. Doubling the absolute pressure to 50 psia (35 psig) reduces the O_2 concentration by 1/2.

Ref: SP 1104.27.5, p. 23

5.5 Equilibrium iodine is proportional to power, while equilibrium xenon is not. Therefore, you have a higher ratio of I to Xe at higher power levels. The greater the I to Xe ratio, the longer it takes for sufficient I to decay to Xe such that an equilibrium production and decay of Xe is occurring (i.e., the peak).

Ref: Licensing Info Manual, Vol. 1, p. I-65

5.6 The temperature increases up to 80 to 85% power then actually decreases. Tave is constant from 25 to 100% power, while T_H is increasing from about 590 to about 605°F. T_{STM} which is being superheated follows the T_H curve slope up to about 70 or 75% power. At the higher power level the superheat region length is decreasing by so much that there is not enough heat transfer area to allow adequate superheat [remember $Q=UA(T_{PRIM}-T_{STM})$], so the actual T_{STM} outlet decreases.

Ref: Licensing Info Manual, Vol. 1, p. II-35

5.7 d. Reasons not required, but a-c are the reasons and "d" is a false statement.

Ref: Licensing Info Manual, p. II-A4

5.8 b.

Licensing Info Manual, p. II-272

5.9 1. The assembly lies between a detector and source;

2. The assembly was placed immediately adjacent to a detector.

Ref: Licensing Info Manual, p. III-26

5.10 Worse at lower powers, since delta Tc's would be worse at lower power levels.

Ref: PP 1102.02.15, p. 39

5.11 a. Imposed to prevent expansion of fuel defects in "water-logged" fuel pins, if any occur. These will occur only if the cladding would have a minute through-the-wall defect. When the RCS is pressurized during startup operations, coolant would leak through the cladding and into the fuel pin. Upon return to power, the increased fuel temperature causes this water to flash to steam and pressurize the fuel pin.

By increasing power to 20% at a rate of 10% per hour, the steam pressure inside the fuel pin will be allowed to seep back into the RCS.

b. The two five-hour holds at 75% and 90% are also to allow stress relaxation to minimize the effects of pellet/clad interactions. These stresses are due primarily to the rapid expansion of the fuel pellets as compared to the slower expansion of the clad. This could be a particular problem if a fuel pellet is cocked in the fuel pin and therefore, it would be expanding against the cladding. The holds allow time for pellet and clad creep to accommodate the differential thermal expansion.

Ref: PP 1102.04.11, p. 29 & 30

5.12 In NC there is no circulation in the reactor vessel head, which is only cooling down via losses to ambient at approximately 1.5°F/hr. You can either get a steam bubble formation in the head, or create an overstressing (thermal) of the vessel head bolts. Either answer acceptable.

Ref: PP 1102.10.11, p. 52

5.13 a. 1/2 hour

Ref: EP 1202.01, p. 110

5.14 Given (delta K) = -6%, Ci = 50 cps, Cf = 300 cps

$$K = \frac{1}{1-(\text{delta } K)} = \frac{1}{1.06} = .943 \text{ / Assumption (delta K) = K-1 ok}$$

$$\frac{C_1}{C_2} = \frac{1-K2}{1-K1} = \frac{50}{300} = \frac{1-K2}{1-.943}$$

$$\frac{50(.057)}{300} = 1-K_2 \quad \therefore K_2 = .9905$$

$$(\text{delta } K) = \frac{K-1}{K} = \frac{.9905-1}{.9905} = -.00959 \text{ or about 1\% S/D}$$

Ref: Lic Info Manual, p. I-50

5.15 a. True

b. True

Ref: Licensing Info Manual, p. I-43&44

5.16 Imbalance

Ref: Tech Specs, B2-2 & 2-6

5.17 This limitation is required to ensure (1) the moderator temperature coefficient is within its analyzed temperature range, (2) the protective instrumentation is within its normal operating range, (3) the pressurizer is capable to being in an OPERABLE status with a steam bubble, and (4) the reactor pressure vessel is above its minimum RT_{NDT} temperature.

Ref: Tech Specs, p. B 3/4 1-2

6.0 PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION

6.1 If ICS auto power does not exist, selection of the AUTO mode is prevented. If neutron error is greater than 1%, selection of the AUTO mode is prevented. However, with reactor demand station and reactor rod control panel in MANUAL, neutron error is tied back and error should equal zero. For this reason, whenever the rod control panel is placed in HAND, the reactor demand station should also be placed in HAND to minimize upsets.

Ref: SP 1105.09.6, p. 15

6.2 b. 50°F in 1/2 hour.

Ref: Enclosure 4 to SP 1105.09.3

6.3 a. On low steam pressure on one steam line, steam and feedwater are isolated to and from each steam generator. In addition, both auxiliary feed pumps are aligned to take steam from and to feed the steam generator which is above 612 psig.

b. On high feed-steam dp or low OTSG level on one steam generator, feed and steam are isolated to and from both OSTG's and each auxiliary feed pump is aligned to feed its own steam generator.

Ref: SP 1105.16.5, p. 4

6.4 True

Ref: SP 1106.09.19, p. 7

6.5 False - The capacity is significantly less, and requires special care prior to switching over from MFPT to SUFP (reason not needed for credit).

Ref: SP 1106.07.6, p. 14

6.6 Any one of the three below is adequate for full credit.

Three pumps are required for the cascading of drains back to the condenser from one train or one high pressure plus one low pressure train at turbine full power. Three pumps are also required at full load if both LP heater drain pumps are out of service.

Ref: SP 1106.16.8, p. 1

6.7 Transfer must be made slowly to allow the governor system time to respond without significant speed variations.

Ref: SP 1106.20.7, T8214, p. 1

6.8 a. #3
b. #1
c. #3

Ref: SP 1106.24.4, p. 3

6.9 The breaker will trip, but only if the pump is not running.

Ref: SP 1107.05.10, p. 4

6.10 The fail-to-start relay will time out and shutdown the diesel.

Ref: SP 1107.11.15, Temp Mod, 9/5/84

6.11 a. It would give a falsely high indication.

b. Pzr. and OTSG level

Ref: SP 1103.05.16, p.10

6.12 b. The "start" signal must be momentarily removed, then reinitiated.

Ref: SP 1104.12.13

6.13 If the temperature reaches approximately 302°F (# not needed for credit) the charcoal reaches its desorption temperature and will begin releasing the radionuclides.

Ref: SP 1104.15.14, p. 2

6.14 1. At least 1 MFP not tripped
2. All control valves in "Auto" (both main and startup)
3. RFR defeat switch in "On" position
4. Reactor trip.

Ref: SP 1105.04.7, p. 3

6.15 False - Emergency stop bypasses valve closure to stop circuitry.

Ref: Licensing Info Manual, p. II-87

6.16 a. 3
b. 1
c. 2
d. 4

Ref: Licensing Info Manual, p. II-135/136

6.17 a. 4
b. 2
c. 1
d. 3

Ref: Licensing Info Manual, p. II-155 thru II-159

6.18 1. Engine overspeed
2. Generator bus differential
3. Overcurrent

Any three but-

Ref. Licensing Info Manual, p. II-210

6.19 1. SFAS signal present, and
2. Equipment BLOCK pushbutton is depressed, and
3. Equipment is in a NON-SFAS condition

Ref: Licensing Info Manual, P. II-213

6.20 b. - that trips an RPS Channel

Ref: Licensing Info Manual, p. II-223

6.21 True

Ref: EP 1202.01, p. 98

7.0 PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL

7.1 Trip the unit - Reason not required but "decelerating to a lower speed and holding" will usually result in internal damage to the turbine.

Ref: SP 1106.01.13, p. 4

7.2 De-energize the fan, then re-start in slow (interlocks prevent going straight from "Fast" to "Slow").

Ref: SP 1104.08.7, p. 4

7.3 With one station vent radiation monitor (RE4598BA,AA) out of service, a single failure (failure of the remaining RE) would render both RE's out of service thus preventing isolation of the CTRM normal ventilation during a high radiation condition. Therefore by placing the CTRM normal ventilation in recirculation mode the amount of air inleakage into the CTRM will be reduced in the event of a high radiation condition coincident with the failure of the remaining station vent RE. The air inleakage is thus minimized until operator action would be taken to isolate the CTRM HVAC and manually start the CTRM EVS(½ credit only if states that it is a Tech Spec Requirement).
Ref: Sp 1104.14.9

7.4 Minimum - 50°F Maximum - 90°F

Ref: Sp 1104.66.10, p. 1

7.5 False - reduce feedwater demand

Ref: SP 1105.04.1, p. 18

7.6 a. 3 b. 1 c. 2

Ref: Licensing Info Manual, p. I-111

7.7 The automatic vacuum controller (PIC-1061). The PCV (PCV-1061) fails open on a loss of instrument air which requires the operator to manually isolate PCV-1061, and control vacuum at VS-60 manually (valve #'s not required). If tripped, break vacuum.

Ref: Licensing Info Manual, p. II-79

7.8 Analyze mode at power and in the gross mode when the reactor is shut down. When the reactor is at power, sufficient background radiation will be present in the main steam line areas to cause a false trip of the MS line rad monitors if they are left in the gross mode. When reactor is S/D there is no N-16 so must be in gross mode

Ref: PP 1102.02, Addendum & PP 1102.03, Addendum

7.9 To prevent automatically increasing the main steam header pressure control setpoint by 145 psig.

Ref: PP 1102.10.12, p. 27

7.10 Borate to 1800 ppmb ~~a assure 1% SDM~~

Ref: EP 1202.01, p. 19 (~~1~~ pt for borate, ~~.5~~ pt for 1800 ppm)

Procedure Revised

7.11 100"

Ref: EP 1202.01, p. 87

7.12 Throttle -

- MU/HPI must be throttled to prevent exceeding the Vessel Integrity Limit Line.
- HPI must be throttled, during piggyback operation, to limit HPI pump flow to < 950 gpm per pump.
- ~~If core cooling is NOT being provided by MU/HPI cooling (at least one SG is available as a heat sink),~~ HPI may be throttled and normal MU flow established when adequate subcooling margin has been restored and pressurizer level is > 100" and increasing.
- Also MU must be throttled to > 1500 psig

Terminate -

- HPI may be stopped if the LPI system has been started and flow has been ≥ 1000 gpm/line for ≥ 20 minutes.
- If core cooling is NOT being provided by MU/HPI cooling (at least one SG is available as a heat sink), HPI may be stopped and normal MU flow established when adequate subcooling margin has been restored and pressurizer level is > 100" and increasing.

Ref: EP 1202.01, p. 141

7.13 a. ~~40~~ 50" (~~44~~" if feeding other S/G)
b. ~~93~~ 124" (~~97~~ 128" if feeding other S/G)

Ref: EP 1202.01, p. 142

7.14 Because of potential fuel assembly bow, the assembly may still be straddling two positions. Must verify correct its position with a video camera or binoculars.

Ref: PP 1501.01.5, p. 10

7.15 Automatic runback should be stopped and boric acid added. However, per requirement the power must be reduced to ≤60% within 1 hour.

Ref: AB 1203.23, p. 3

7.16 . Two man entry
. Continuous HP coverage
. Two different types of high range survey instruments.

Ref: HP 1601.04.11, p. 6

7.17 True

Ref: AD 1827.08.1, p. 4

7.18 Primary to secondary heat transfer is NOT excessive when the RCS pressure and temperature and SG pressure combinations, on the P/T display or manual plot show the following trends:

1. Plant is stable in or approaching the post trip target box,

or

2. Plant is stable outside the post trip target box,

and

SG pressure is above the steam pressure limit of 960 psig.

Ref: EP 1202.01, p. 41

8.0 ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS

8.1 Do not open the hydraulic system piping, install servovalves, or other components when the air is full of contaminants. For example, one of the worst possible times would be when heat retention lagging is being cut and fitted.

Ref: Precaution in SP 1105.12.1, p. 4

8.2 a. 10 MW

Ref: SP 1106.09.6

8.3 1. SS and 2 others knowledgeable regarding the plant electrical equipment:

The two other persons should preferably be (1) either the Operations Engineer, Operations Supervisor, or Operations Engineering Supervisor and (2) either the Maintenance Engineer or Maintenance Supervisor. For the switchyard, main generator and Main Startup, and Aux Transformers the Load Dispatcher shall also be consulted.

Ref: SP 1107.04.5, p. 7-8, SP 1107.05.10, p. 7

8.4 Chemistry and HP personnel on duty must be notified to verify boron concentration.

Ref: SP 1104.01.14

8.5 a.

Ref: T-Mod for SP 1104.24

8.6 "Any evidence of an RCS Leak" requires Station Superintendent permission.

Ref: LSP 1105.03.11, p. 5

8.7 Desire to limit the total dissolved solids in the cooling tower system to approximately twice that of lake water. Therefore, the blowdown is made approximately equal to the evaporative losses. Stop scale formation on condenser tubes.

Ref: Licensing Info Manual, p. II-91

8.8 a. 1 hour
b. Emergency Telephone

Ref: AD 1839.00, p. 2

8.9 50%

Ref: AD 1839.00.7, p. 3 (Addendum)

8.10 The reason for this requirement is to perform the immediate operation action, Step 2.3.1 of EP 1202.06, Loss of Reactor Coolant and Reactor Coolant Pressure, which specifies tripping of Reactor Coolant Pumps, if SFAS incident levels 1 and 2 have been actuated and RCS pressure is less than 1650 psig. The second Reactor Operator is also required to manually transfer ECCS pumps suction from the BWST to the Emergency Sump, if necessary.

Ref: DB, Special Order 26-3

8.11 a. Normally closed
b. Normally open
c. Throttled position

Ref: Drawing M-001 (P+IDs)

8.12 c. Only a confirming survey need be performed.

Ref: PP 1501.01.6, p. 12

8.13 a. . Flammable liquids such as lube oil, grease, and fuel oil
. Dry chemical (foam for FO)

b. . Electrical equipment
. CO_2

Ref: AB 1203.37.0

8.14 True

Ref: HP 1601.03.7, p. 9

8.15 a. . Located at the Conference Room and offices on the fifth floor of the Station Office Building

. to provide an area for plant personnel not on shift or not immediately required for plant control to muster for subsequent assignment to duties in support of emergency operations

b. . Located within the non-restricted area of the DBAB first floor

.. to provide protected accommodations for the State and local officials providing communications and coordination with emergency response agencies offsite.

c. . North end, first floor, DBAB

. to house and support an organization that provides management and technical assistance to the Station operations personnel during emergency conditions and to prevent or mitigate the consequences of abnormal plant conditions.

d. . North end, first floor, DBAB

. to provide a centralized management focal point for protective action planning and continuous coordination and control of onsite and offsite emergency activities.

Ref: Emergency Plan, Vol. 1, p. 7-3 thru 7-5

8.16 75 Rem / Ref: EI 1300.00.5, p. 4, Temp Mod.

8.17 Shift Supervisor / Ref: EI 1300.11.2, p. 1

8.18 1 hour / Ref: EI 1300.12.4, p. 4

8.19

MODE	REACTIVITY CONDITION, K_{eff}	%RATED THERMAL POWER*	AVERAGE COOLANT TEMPERATURE
1. Power Operation	$\geq$ 0.99	$>$ 5%	$\geq$ 280°F
2. Startup	$\geq$ 0.99	$<$ 5%	$\geq$ 280°F
3. Hot Standby	$<$ 0.99	0	$\geq$ 280°F
4. Hot Shutdown	$<$ 0.99	0	280°F $\geq T_{avg} >$ 200°F
5. Cold Shutdown	$<$ 0.99	0	$<$ 200°F
6. Refueling**	$<$ 0.95	0	$\leq$ 140°F

*Excluding decay heat
**Reactor vessel head unbolted or removed and fuel in the vessel.
(asterisked items not required)

Ref: Tech Specs, p. 1-7

8.20 1.25 X 7 days / Ref: Tech Specs, 3/4 0-1

-End of Answer Key-