U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-237/OL-86-02

Docket Nos. 50237; 50-249 License No. DPR-19/25

Licensee: Commonwealth Edison Company
Post Office Box 767
Chicago, Illinois 60690

Facility Name: Dresden Nuclear Power Station

Examination Administered At: Dresden Nuclear Power Station, Morris, Illinois

Examination Conducted: June 24-27, 1986

Examiners: D. E. Hills for
M. Spencer — Date 8/5/86

D. E. Hills for
J. Hanek — Date 8/5/86

Approved By: T. M. Burdick
T. M. Burdick, Chief
Operator Licensing Section — Date 8/5/86

Examination Summary

Examination administered on June 24-27, 1986, (Report No. 50-237/OL-86-02)
Written and operating examinations were administered to three Senior Reactor Operator (SRO) candidates and three Reactor Operator (RO) candidates. In addition, one simulator portion of the operating examination was administered to an RO candidate.
Results: One SRO and one RO candidate passed these examinations. All others failed one portion of the examination.

REPORT DETAILS

1. Examiners

M. Spencer, INEL - Chief Examiner
J. Hanek, INEL

2. Examination Review Meeting

An examination review meeting is no longer conducted. Specific facility comments concerning written examination questions, followed by the NRC response, are enumerated in Attachments 1 and 2.

3. Exit Meeting

At the conclusion of the examinations, an exit meeting was held. The following personnel attended this exit meeting:

Facility Representatives
R. Flessner
J. Wujciua
B. Zank
S. Stiles

NRC Representatives

L. McGreger, Senior Resident Inspector, Dresden
M. Spencer, Chief Operator Licensing Examiner, INEL

The following observations and generic issues were discussed:

a. A deficiency in the knowledge level understood by candidates concerning the fire protection systems and basic health physics principles was noted by the examiners.

b. The insufficient use of and lackadaisical attitude toward procedures during the simulator examination were noted by examiners.

c. Interruptions by personnel in the control room were disruptive to the oral examination process.

ATTACHMENT 1

DRESDEN STATION COMMENTS

RO EXAM 6/24/86

Facility Comment:

1.06 b. Answer is incorrect, the correct answer is: The condition in which the reactor is not dependent on delayed neutrons.

Examiner Response:

1.06 b. Facility comment is valid. Answer key was changed for 1.06 b as follows: Prompt critical is the condition in which the reactor is not dependent on delayed neutrons.

Facility Comment:

1.07 b. See SRO Exam comments 5.05 b.

Examiner Response:

1.07 b. There is no facility comment addressed against SRO question 5.05.B. Duplicate question concerning NPSH is 5.04.B answer key for 1.07 b was changed as follows:

NPSH is defined as the difference in pressure between the static pressure at the eye of a pump and saturation pressure.

Facility Comment:

2.01 Additional acceptable answers:

4. Isolation Condenser Drains
5. Isolation Condenser Loop Seals
6. Fuel Pool Cooling Heat Exchanger Drains
7. Fuel Pool Cooling Heat Exchanger Relief Valves
8. Shutdown Cooling Heat Exchanger Relief Valves and Drains
9. RBCCW Heat Exchanger Drains
10. RBCCW Heat Exchanger Relief Valves
11. RBCCW Header Drain
12. RBCCW Pump Bed Drains
13. RBCCW Head Tank Drains
14. Core Spray/LPCI Corner Room Sump Pumps
15. Isolation Condenser Condensate Header Drain

16. Shutdown Cooling-5 Valve Drains
17. LPCI Header Drains
18. HPCI Booster Pump Suction Relief Valve
19. HPCI Room Sump Pumps
20. HRSS Building Sump Pumps
21. Containment Cooling Service Water Head Exchanger Drains

Examiner Response:

2.01 Facility comment is not valid. Question specifically asked for inputs other than from floor drains. Reference material, Dresden Student Text, Liquid Radwaste System, Book 4 Chapter 1 lists the three inputs given in the answer key and floor drains.

Facility Comment:

2.02 a. Additional acceptable answer: Afterfilter

b. This question is inappropriate for a reactor operator written exam. The location of pipe taps on a non-safety related system is out of the realm of required knowledge of a reactor operator. This question lends itself to the oral exam rather than a written exam.

Examiner Response:

2.02 a. Answer key was changed to include afterfilter as an acceptable answer for 2.02 a. Point value breakdown was adjusted for the additional answer. Reference material was supplied by facility.

2.02 b. Facility comment is noted but not valid. This question is consistent with the requirements of ES-202 B.2 as follows:

"The candidate should be able to reproduce, from memory, sketches or descriptions of various hydraulic, pneumatic, or electrical distribution systems and mechanical components. Questions on design intent, construction, operation, and interrelationships of those systems most directly associated with normal nuclear power plant operation and reactor safety can also be included."

Facility Comment:

2.04 This is an inappropriate question for a Reactor Operator exam. This valve is under the control of a non-licensed operator and not the Reactor Operator.

Examiner Response:

2.04 Facility comment is not valid. This question is consistent with the requirements of ES-202 B.2. Furthermore, the non-licensed operator is under the direction of the licensed reactor operator.

Facility Comment:

2.07 a. Answer should also include: "OR"

1. Rx Water Level </=-59"
2. 8.5 minute timer timed out
3. Any core spray or LPCI pump running with >/=100 psig pressure.

Examiner Response:

2.07 a. Facility comment is valid. Reference material dated July, 1984 provided by the facility included the additional actuation signal of reactor water level less than -59 in. and 8.5 min. timer timed out and either core spray or any LPCI pump running with at least 100 psig discharge pressure. Answer key was changed to include these additional requirements. Point value breakdown was adjusted for the additional answers. Reference material was provided by the facility which was not included in the material supplied to the examiner.

Facility Comment:

2.10 c. See SRO Exam comments 6.12 c.

Examiner Response:

2.10 c. This question is a practical application of a basic theory concept and is consistent with ES-202 B.2. Answer key is correct with respect to Dresden Student Text, Standby Liquid Control, Book 3 Chapter 3 Page 11. It does not elaborate on the method utilized to prevent chugging.

"The minimum injection time is 50 minutes.

1) A too rapid insertion rate results in a lack of proper mixing and reactivity "chugging". The objective is to provide for a controlled shutdown: Too fast a shutdown, with its accompanying power "chugging", could damage the Fuel."

Facility Comment:

4.10 3. Answer is incorrect, correct answer is: Range 3

Examiner Response:

4.10 3. Facility comment is valid. Reference material was supplied to support the correct answer of Range 3 instead of Range 4 as described in Dresden Operating Procedure DOP 700-1.

Facility Comment:

4.13 b. Technical Specification bases are considered to be beyond the realm of knowledge of a Reactor Operator candidate. Therefore, this is an inappropriate question.

Examiner Response:

4.13 b. Facility comment is not valid. In addition to being a Tech Spec requirement, this procedure is identified in Dresden Operating Procedure DOP-300-7. This question is consistent with ES-202 B.2 which states the candidate should be able to explain reasons, cautions, and limitations of normal operating procedures.

Additional Examiner Comments:

1.04 b. Answer key 39.93 changed to 38.93 typographic error.

3.01 e. Answer key 20 seconds not required for full credit. Answer key changed to A time delay.

3.03 3 Answer key psia changed to psig.

3.04 c. Question clarified as flood-up during exam.

3.04 d. Question clarified as fuel zone during exam.

4.11 2. Answer key "not" was deleted typographic error.

4.18 b. Answer key VARIAC is an acceptable answer for EXC field VAR AC control.

ATTACHMENT 2

DRESDEN STATION COMMENTS

SRO EXAM 6/24/86

Facility Comment:

5.04 B. Answer Key should be: "The difference in pressure between the static pressure at the eye of the pump and saturation pressure." The answer key currently defines "Required NPSH".

Examiner Response:

5.04 B. Answer Key was changed as follows: NPSH is defined as the difference in pressure between the static pressure at the eye of a pump and saturation pressure. Correct reference material was supplied by facility.

Facility Comment:

5.09 This question regards an obscure point and has been commented about on previous exams.

Examiner Response:

5.09 Comment noted. Question is consistent with ES-402.A.1 regarding fuel element characteristics.

Facility Comment:

6.06 b. The answer key is not correct. The answer key response describes the function for the Backup Scram Valves. The correct function is: "To supply instrument air to the SDV vent and drain valves to hold the valves opn."

Examiner Response:

6.06 b. Facility comment is not valid. Dresden Student Text, Control Rod Drive Hydraulic System, Book 1 Chapter 6 Page 26 describes the function of the scram dump valves (20 A/B) and backup scram valves (19 A/B) as follows:

F. 5. n. 2) a) "LOW SCRAM AIR HEADER PRESSURE (less than 50 psig at PS-992 and B). This interlock anticipates control rods inserting

in a random pattern as their scram inlet/outlet valves overcome spring pressure. To preclude random rod insertion patterns, the following valves are energized on low air header pressure: 19A, 20A, 20B.

This function is bypassed when the SDV Hi Hi Level Scram? Bypass Keylock switch is in "BYPASS".

Facility Comment:

6.12 c. This question is thought provoking and the information is not specifically mentioned in the lesson plan or the FSAR. Therefore, the specific response listed in the answer key should not be the only acceptable answer.

Examiner Response:

6.12 c. This question is a practical application of a basic theory concept and is consistent with ES-402A.2 concerning design intent. Answer key is correct with respect to Dresden Student Text, Standby Liquid Control, Book 3 Chapter 3 Page 11.

"The minimum injection time is 50 minutes.

1) A too rapid insertion rate results in a lack of proper mixing and reactivity "chugging". The objective is to provide for a controlled shutdown: too fast a shutdown, with its accompanying power "chugging", could damage the fuel."

Facility Comment:

7.03 a. Answer should be:
Step 1: Start both CRD Pumps
Step 2: Close charging water valve 2(3)-0301-25
Step 3: Rapidly insert all control rods using the Emergency Rod-in Control Switch.

Examiner Response:

7.03 a. Facility comment is valid. Steps 1 and 3 of Facility Comment were added to answer key. Point value breakdown was adjusted for additional answers. Reference material was supplied by facility.

Facility Comment:

7.03 c. "Cram Arrays" should also be acceptable.

Examiner Response:

7.03 c. Answer key was changed to include "Cram Array" or "Deep" rods for full credit. High worth was deleted from answer key, reference material was provided by facility.

Facility Comment:

7.09 b. Question was changed to read: A Type 1 RWP is valid for

1. _____ while a Type 2 RWP is valid for
2. _____.

Answer therefore are:

1. 1 year
2. Length of the Job

Examiner Response:

7.09 b. Facility comment is valid. Dresden Radiation Protection Standards were changed in September, 1985 to incorporate Type 1 and Type 2 RWP's, Exam Reference Material was dated February 1982. 7.09 b. answer key was changed in accordance with the facility comment and revised Dresden Radiation Standards Pages 11-14.

Facility Comment:

7.10 b. Answer key should read:
Less urgent action 100 REM

Examiner Response:

7.10 b. Facility comment is valid, answer key 7.10 b. was changed to 100 REM for extremities dose during less urgent action conditions. Answer key was a typographic error.

Facility Comment:

8.12 We do not expect license candidates to memorize tables in the Technical Specifications, especially in this case where the station manning always exceeds the requirements. We consider this question to be inappropriate.

Examiner Response:

8.12 Facility comment is not valid ES-402-A.4. states that "Questions may also cover the requirements for certain personnel to be present at certain times" and questions pertaining to shift manning are consistent with this requirement.

Additional Examiner Comments:

5.01 B Answer key 39.93 changed to 38.93 - typographic error.

7.12 C Question collect changed to collet - typographic error.

6.04 C Question clarified as "flood-up" during exam.

6.04 D Question clarified as "Fuel Zone" during exam.

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

FACILITY: DRESDEN 2&3

REACTOR TYPE: BWR-GE3

DATE ADMINISTERED: 86/06/24

EXAMINER: HANEK, J.

APPLICANT: _____

MASTER COPY

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses 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	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.50	25.00	_____	_____	5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
24.25	23.77	_____	_____	6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.25	24.75	_____	_____	7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
27.00	26.47	_____	_____	8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
102.00	100.00	_____	_____	TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

3. Use black ink or dark pencil only to facilitate legible reproductions.

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

    a. Assemble your examination as follows:

        (1) Exam questions on top.

        (2) Exam aids - figures, tables, etc.

        (3) Answer pages including figures which are a part of the answer.

    b. Turn in your copy of the examination and all pages used to answer the examination questions.

    c. Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.

    d. Leave the examination area, as defined by the examiner. If after leaving, you are found in this area while the examination is still in progress, your license may be denied or revoked.

5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS

QUESTION 5.01 (3.00)

The reactor is shutdown and a plant cooldown is in progress. Reactor pressure decreases from 450 psia to 300 psia in a 30 minute period. SHOW ALL WORK.

A. What is the cooldown rate? (1.5)

B. How much reactivity has been inserted in the rector due to the moderator temperature coefficient (MTC)? (1.0)

C. With the above temperature change, has the MAGNITUDE of the MTC changed and if so, in what direction (more/less, positive/negative)? (.5)

QUESTION 5.02 (2.00)

Regarding MCPR (Minimum Critical Power Ratio):

a. What PHENOMENON could exist in a fuel fundle if it were operated at a MCPR LESS THAN ONE (< 1.0) and WHAT would very likely be the CONSEQUENCE of the phenomenon? (1.0)

b. WHY must the Technical Specification MCPR limit be modfied when core flow is LESS THAN RATED? (Include in your answer whether MCPR is increased or decreased.) (1.0)

QUESTION 5.03 (2.00)

a. Which time in core life (BOL, Mid-of-life, or EOL) requires the least amount of positive reactivity addition to achieve prompt critical AND why?

b. When is prompt critical achieved?

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.04 (2.50)

A. What are THREE of the FIVE design or operational factors that insure adequate Net Positive Suction Head (NPSH) for the recirculation pumps? (1.5)

B. Explain what NPSH is. (1.0)

QUESTION 5.05 (1.50)

Give ONE undesirable result for each of the following. (Be more specific than "pump failure"):

A. Operating a centrifugal pump for extended periods of time with the discharge valve shut. (0.5)

B. Starting a centrifugal pump with the discharge valve full open. (0.5)

C. Operating a motor driven pump under "PUMP RUNOUT" conditions. (0.5)

QUESTION 5.06 (2.00)

A. DEFINE "Condensate Depression". (.5)

B. WHY is it necessary for plants to operate with condensate depression? (1.0)

C. HOW would CYCLE EFFICIENCY be effected if the amount of condensate depression is increased? (.5)

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.07 (1.50)

In a reactor fueled with U-235 and U-238:

A. Which nuclide(s) may fission upon absorbing a fast neutron? (.5)

B. What fissile nuclide can U-238 be converted into? (.5)

C. At the Middle of Core Life (MOL), which 2 nuclides will absorb a thermal neutron and fission? (.5)

QUESTION 5.08 (2.00)

For the following transients, indicate which COEFFICIENT of reactivity; alpha T, alpha D, or alpha V tends to change reactor power FIRST and in what DIRECTION.

A. Fast closure of one MSIV. (0.5)
B. Isolation of a feedwater heater string. (0.5)
C. A control rod drop. (0.5)
D. Relief valve lifting. (0.5)

QUESTION 5.09 (1.00)

The 8x8 fuel has a thermal time constant of approximately 5 to 6 seconds. This means that in 5 to 6 seconds following a sudden power increase: (choose ONE answer below) (1.0)

a. The fuel centerline temperature will reach its maximum (final) value.

b. Clad surface temperature will reach its final value.

c. Fuel centerline temperature will reach approximately 2/3 of its final value.

d. Fuel centerline, clad and coolant temperature have reached their final values.

e. Clad surface temperature will reach approximately 63% of its final value.

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.10 (2.00)

Indicate HOW each of the coefficients are effected [Increase, Decrease or Remain the same] by each of the three parameters listed? Consider each parameter separately.

a. Rod Worth (delta K/K/Bank) by:
   1. Moderator temperature INCREASES
   2. Voids DECREASE
   3. Fuel temperature INCREASES [3 @ 0.33 ea]

b. Alpha Voids (delta K/K/ % voids) by:
   1. Fuel temperature INCREASES
   2. Core age INCREASES
   3. Control Rod Density INCREASES [3 @ 0.33 ea]

QUESTION 5.11 (1.00)

In a subcritical reactor, Keff is increased from .880 to .965. Which of the following is the amount of reactivity added to the core?

a. .085 delta k / k

b. .100 delta k / k

c. .125 delta k / k

d. .220 delta k / k

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.12 (1.00)

The reactor trips from full power, equilibrium XENON conditions. Twenty-four hours later the reactor is brought critical and power level is maintained on range 5 of the IRMs for several hours. Which of the following statements is CORRECT concerning control rod motion?

a. Rods will have to be withdrawn due to XENON build-in.

b. Rods will have to be rapidly inserted since the critical reactor will cause a high rate of XENON burnout.

c. Rods will have to be inserted since XENON will closely follow its normal decay rate.

d. Rods will approximately remain as is as the XENON establishes its equilibrium value for this power level.

QUESTION 5.13 (1.00)

Concerning control rod worths during a reactor startup from 100% PEAK XENON versus a startup under XENON-FREE conditions, which statement is correct? (1.0)

a. BOTH control rod worths will be LOWER regardless of core XENON conditions.

b. CENTRAL control rod worth will be HIGHER during the PEAK XENON startup than during the XENON-FREE startup.

c. BOTH control rod worths will be the SAME regardless of core Xenon conditions.

d. PERIPHERAL control rod worth will be HIGHER during the PEAK XENON startup than during the XENON-FREE startup.

(***** CATEGORY 05 CONTINUED ON NEXT PAGE *****)

QUESTION 5.14 (2.00)

A significant amount of excess reactivity must be loaded into a core at BOL so that 100% power can be attained at the end of a fuel cycle. For each of the following, LIST the approximate value of K-excess which must be loaded to overcome that negative reactivity component at rated-equilibrium conditions.

a. Moderator temp increase

b. Void fraction increase

c. Samarium buildup

d. Xenon buildup

QUESTION 5.15 (1.00)

STATE for which condition the reactivity coefficient contribution would be MORE NEGATIVE. EXPLAIN your choice.

Moderator Void Coefficient for a 1% INCREASE in void fraction at 10% void fraction in the core,

-OR-

Moderator void coefficient for a 1% INCREASE in void fraction at 70% void fraction in the core.

(***** END OF CATEGORY 05 *****)

QUESTION 6.01 (3.00)

Other than injection of sodium pentaborate, list FOUR functions of the standby liquid control nozzle penetration.

QUESTION 6.02 (2.00)

a. Why are risers utilized on the jet pumps?

b. What would be the detrimental effects of not utilizing risers?

QUESTION 6.03 (2.50)

Other than the Emergency Core Cooling Systems, list FIVE of the SIX systems or components that constitute the engineered safeguards at Dresden.

QUESTION 6.04 (3.00)

For each of the below listed vessel level indications, provide the following:

1. Range
2. Method of temperature compensation (if any)
3. Major control functions besides indication and alarm (if any).

a. Narrow Range GE/MAC

b. ATWS Level Transmitter

c. Wide Range GE/MAC

d. Wide Range Yarway

QUESTION 6.05 (1.00)

With respect to the Narrow Range Yarway instrument, what affect will the following have on indicated level?

a. Increase in Drywell Temperature
b. Increase in Reactor Building Temperature near the Instrument Rack.

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.06 (2.75)

With respect to the scram dump valves (20A and 20B), provide the following:

a. Actuation signal(s) (setpoint not required) (1.0)

b. Function (0.75)

c. Power supply (0.5)

d. When function is bypassed (0.5)

QUESTION 6.07 (1.75)

With respect to the RWM, what signal(s) are utilized to actuate and deactuate the LPSP and LPAP (include applicable setpoints and times).

QUESTION 6.08 (.75)

In the event of a failure of both recirc pump seals, the a._____ b._____ limits the total flow to c._____ gpm.

QUESTION 6.09 (.50)

Following an auto initiation of HPCI, the low pressure sensing line from the HPCI flow element (FE-2-2356) ruptures. (Assume 1000 psig Rx pressure.)

After this rupture, what will the HPCI turbine speed, assuming no operator action?

QUESTION 6.10 (1.25)

Hydrogen is added to the reactor coolant to reduce the a._____ in the coolant in an effort to reduce b._____. Oxygen is added to the offgas system to c._____ with the excess d._____ to reduce the potential of offgas e._____.

(***** CATEGORY 06 CONTINUED ON NEXT PAGE *****)

QUESTION 6.11 (2.75)

The Off-Gas HI-HI Radiation Trip logic will initiate on TWO conditions.

a. What are these conditions? (1.0)

b. List THREE auto actions that will result from a trip condition following timeout of the Timer. (1.5)

c. What is the setting of the Timer? (0.25)

QUESTION 6.12 (2.00)

Concerning the Standby Liquid Control Pumps.

a. What is the power supply(s) to the pump motors? (0.5)

b. Briefly, what is the voltage supply and power to the squib valves? (0.5)

c. Briefly, explain why positive displacement pumps are utilized instead of centrifical pumps. (1.0)

QUESTION 6.13 (1.00)

Concerning the Halon 1301 fire suppression system.

a. What areas are protected by this system? (0.5)

b. True or False
   1. Halon 1301 relies on the displacement of oxygen to extinguish fires. (0.25)
   2. The system is suitable for use in enclosed occupied spaces. (0.25)

(***** END OF CATEGORY 06 *****)

QUESTION 7.01 (2.75)

What are the FOUR entry conditions for the Reactor Control Procedure (DEOP 100)? Include applicable setpoints.

QUESTION 7.02 (1.50)

Irrespective of the entry condition, what other DEOP's are executed concurrently if DEOP 100 is entered.

QUESTION 7.03 (1.50)

a. During an ATWS condition, what action must be taken to drive rods if the scram signal cannot be reset. (0.5)

b. Why is this action necessary? (0.75)

c. What rods have the highest initial priority to insert? (0.25)

QUESTION 7.04 (2.00)

APRM AGAFS require adjustment if they are a._____ and reactor power is b._____. If reactor power is below c._____ the AGAF's are set at d._____.

QUESTION 7.05 (2.00)

a. When may the vacuum breakers be utilized to slow the main turbine?

b. How much vacuum decrease is recommended?

c. What vacuum limitations are imposed on their use?

d. Why is their use restricted?

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.06 (2.50)

With regard to routine power changes DGP 3-1 requires radiation-chemistry shall be notified for at least three conditions regarding power changes.

a. List these THREE conditions. (1.5)

b. List TWO actions required if the Building Vent Noble Gas monitor is INOP. (1.0)

QUESTION 7.07 (2.50)

List FIVE automatic actions initiated by a main steam line High Radiation Alarm at 3 X normal.

QUESTION 7.08 (1.50)

Other than a fuel failure or instrument failure, list THREE possible sources of a main steam line High Radiation Signal.

QUESTION 7.09 (1.50)

a. What are FOUR reasons the shift engineer may terminate an RWP? (1.0)

b. A ~~standard~~ TYPE 1 RWP is valid for 1._____ while an ~~extended~~ TYPE 2 RWP is valid for 2._____. (0.5)

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.10 (3.00)

Personnel exposures under emergency conditions references dose limits for life saving actions and less urgent actions.

What are the dose limits for the following under those conditions?

a. Whole body

b. Extremities

c. An acute whole body dose equivalent in excess of 1._____rem shall be limited to 2._____.

QUESTION 7.11 (1.00)

List TWO conditions that must be met prior to placing the economic generation control system in operation with automatic flow control.

QUESTION 7.12 (1.50)

True or False

a. Control rod drives which are fully inserted and electrically disarmed are considered inoperable.

b. During reactor power operation, the number of inoperable control rods shall not exceed eight.

c. Unlimited operation may continue with 3 inoperable control rods if it is determined the cause of failure is CRD collet housing failure.

(***** CATEGORY 07 CONTINUED ON NEXT PAGE *****)

QUESTION 7.13 (2.00)

While the plant is in shutdown cooling with the reactor recirculation pumps not running, surveillance of the vessel metal temperature recorder is required at least once per a.1._____. Stratification is indicated by an increasing a.2._____ temperature without a corresponding a.3._____ or a.4._____ change.

a. List parameters a.1. through a.4.

b. List FOUR suggested actions to minimize stratification if the RWCU system is not available and both recirc pumps are off.

QUESTION 8.01 (1.00)

DAP 7-2 specifies a licensed operator or senior licensed operator shall be "at-the-controls" at all times.

What is the meaning of "at-the-controls"?

QUESTION 8.02 (3.50)

Concerning shift supervisor shift turnover.

a. Where does it take place? (0.5)

b. List SIX of the EIGHT items the oncoming shift supervisor shall review or preform. (3.0)

QUESTION 8.03 (1.50)

a. If the engineering and safety evaluation checklist contains a discrepancy, what approval/actions are required to install a jumper (immediate installation needed) on a backshift? (1.0)

b. What additional action is required if this jumper also reduces the margin of safety as defined in the basis for any Tech. Spec? (0.5)

QUESTION 8.04 (1.50)

a. 10 CFR-20 requires positive control over entry into High Radiation areas. List TWO methods utilized at Dresden to establish this control. (1.0)

b. List TWO personnel who can authorize entry to a High Radiation area in the Reactor Building at Dresden? (0.5)

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.05 (1.50)

Attachment A to DGP 1-1 gives special precautions to prevent a short period event.

After reaching a black and white pattern, what restrictions apply?

QUESTION 8.06 (.50)

True or False

The Shift Engineer and Station Nuclear Duty Officer can authorize plant restart following a scram if the root cause has been determined.

QUESTION 8.07 (2.00)

DOA 202-1, recirculation pump trip requires the operator to reduce the speed of the running recirc pump.

a. What are the limits for each unit at Dresden?

b. What is the bases for this difference?

QUESTION 8.08 (3.00)

In accordance with operating order 5-86, there are specific periods the SCRE is responsible for ensuring an instrument mechanic is on site to perform APRM gain adjustments during plant startup and shutdown. What are these periods? TWO required for each evolution.

QUESTION 8.09 (1.00)

What actions are required by the shift engineer or SCRE if the 4KV cross-tie between Dresden Units 2 and 3 becomes inoperable?

QUESTION 8.10 (3.25)

What are the safety limits at Dresden pertaining to fuel cladding integrity (include applicable plant conditions).

(***** CATEGORY 08 CONTINUED ON NEXT PAGE *****)

QUESTION 8.11 (1.50)

If a Dresden safety limit is exceeded, what actions and reports are required? (Include applicable time limits.)

QUESTION 8.12 (2.25)

a. Answer the following with regard to minimum shift manning requirements. (1.25)

	No. of men in each position				
	SRO	STA	RO	NON LIC	RAD MEN
Unit 1 cold shutdown and second and third units above cold shutdown.	a.1	a.2	a.3	a. 4	a.5

b. What exceptions are allowed to the minimum manning requirements by Tech Specs? (1.0)

QUESTION 8.13 (2.50)

List THREE guidelines to be followed in accordance with Tech Specs to make a temporary change to an operating procedure (include all reviews and approvals required).

QUESTION 8.14 (1.00)

a. A fire brigade of at least a._____ members shall be maintained on-site at all times.

b. Fire brigade training sessions shall be held at least b._____.

QUESTION 8.15 (1.00)

a. What action is required if during normal operation APLHGR thermal limit is being exceeded as determined by normal surveillance.

b. What time limit is allowed to restore APLHGR to within it's prescribed limits before proceeding to cold shutdown?

(***** END OF CATEGORY 08 *****)
(********** END OF EXAMINATION **********)

Temp F	Press. psia	Volume, ft³/lb			Enthalpy, Btu/lb			Entropy, Btu/lb x F			Temp F
		Water v_f	Evap v_{fg}	Steam v_g	Water h_f	Evap h_{fg}	Steam h_g	Water s_f	Evap s_{fg}	Steam s_g	
32	0.08859	0.01602	3305	3305	-0.02	1075.5	1075.5	0.0000	2.1873	2.1873	32
35	0.09991	0.01602	2948	2948	3.00	1073.8	1076.8	0.0061	2.1706	2.1767	35
40	0.12163	0.01602	2446	2446	8.03	1071.0	1079.0	0.0162	2.1432	2.1594	40
45	0.14744	0.01602	2037.7	2037.8	13.04	1068.1	1081.2	0.0262	2.1164	2.1426	45
50	0.17795	0.01602	1704.8	1704.8	18.05	1065.3	1083.4	0.0361	2.0901	2.1262	50
60	0.2561	0.01603	1207.6	1207.6	28.06	1059.7	1087.7	0.0555	2.0391	2.0946	60
70	0.3629	0.01605	868.3	868.4	38.05	1054.0	1092.1	0.0745	1.9900	2.0645	70
80	0.5068	0.01607	633.3	633.3	48.04	1048.4	1096.4	0.0932	1.9426	2.0359	80
90	0.6981	0.01610	468.1	468.1	58.02	1042.7	1100.8	0.1115	1.8970	2.0086	90
100	0.9492	0.01613	350.4	350.4	68.00	1037.1	1105.1	0.1295	1.8530	1.9825	100
110	1.2750	0.01617	265.4	265.4	77.98	1031.4	1109.3	0.1472	1.8105	1.9577	110
120	1.6927	0.01620	203.25	203.26	87.97	1025.6	1113.6	0.1646	1.7693	1.9339	120
130	2.2230	0.01625	157.32	157.33	97.96	1019.8	1117.8	0.1817	1.7295	1.9112	130
140	2.8892	0.01629	122.98	123.00	107.95	1014.0	1122.0	0.1985	1.6910	1.8895	140
150	3.718	0.01634	97.05	97.07	117.95	1008.2	1126.1	0.2150	1.6536	1.8686	150
160	4.741	0.01640	77.27	77.29	127.96	1002.2	1130.2	0.2313	1.6174	1.8487	160
170	5.993	0.01645	62.04	62.06	137.97	996.2	1134.2	0.2473	1.5822	1.8295	170
180	7.511	0.01651	50.21	50.22	148.00	990.2	1138.2	0.2631	1.5480	1.8111	180
190	9.340	0.01657	40.94	40.96	158.04	984.1	1142.1	0.2787	1.5148	1.7934	190
200	11.526	0.01664	33.62	33.64	168.09	977.9	1146.0	0.2940	1.4824	1.7764	200
210	14.123	0.01671	27.80	27.82	178.15	971.6	1149.7	0.3091	1.4509	1.7600	210
212	14.696	0.01672	26.78	26.80	180.17	970.3	1150.5	0.3121	1.4447	1.7568	212
220	17.186	0.01678	23.13	23.15	188.23	965.2	1153.4	0.3241	1.4201	1.7442	220
230	20.779	0.01685	19.364	19.381	198.33	958.7	1157.1	0.3388	1.3902	1.7290	230
240	24.968	0.01693	16.304	16.321	208.45	952.1	1160.6	0.3533	1.3609	1.7142	240
250	29.825	0.01701	13.802	13.819	218.59	945.4	1164.0	0.3677	1.3323	1.7000	250
260	35.427	0.01709	11.745	11.762	228.76	938.6	1167.4	0.3819	1.3043	1.6862	260
270	41.856	0.01718	10.042	10.060	238.95	931.7	1170.6	0.3960	1.2769	1.6729	270
280	49.200	0.01726	8.627	8.644	249.17	924.6	1173.8	0.4098	1.2501	1.6599	280
290	57.550	0.01736	7.443	7.460	259.4	917.4	1176.8	0.4236	1.2238	1.6473	290
300	67.005	0.01745	6.448	6.466	269.7	910.0	1179.7	0.4372	1.1979	1.6351	300
310	77.67	0.01755	5.609	5.626	280.0	902.5	1182.5	0.4506	1.1726	1.6232	310
320	89.64	0.01766	4.896	4.914	290.4	894.8	1185.2	0.4640	1.1477	1.6116	320
340	117.99	0.01787	3.770	3.788	311.3	878.8	1190.1	0.4902	1.0990	1.5892	340
360	153.01	0.01811	2.939	2.957	332.3	862.1	1194.4	0.5161	1.0517	1.5678	360
380	195.73	0.01836	2.317	2.335	353.6	844.5	1198.0	0.5416	1.0057	1.5473	380
400	247.26	0.01864	1.8444	1.8630	375.1	825.9	1201.0	0.5667	0.9607	1.5274	400
420	308.78	0.01894	1.4808	1.4997	396.9	806.2	1203.1	0.5915	0.9165	1.5080	420
440	381.54	0.01926	1.1976	1.2169	419.0	785.4	1204.4	0.6161	0.8729	1.4890	440
460	466.9	0.0196	0.9746	0.9942	441.5	763.2	1204.8	0.6405	0.8299	1.4704	460
480	566.2	0.0200	0.7972	0.8172	464.5	739.6	1204.1	0.6648	0.7871	1.4516	480
500	680.9	0.0204	0.6545	0.6749	487.9	714.3	1202.2	0.6890	0.7443	1.4333	500
520	812.5	0.0209	0.5386	0.5596	512.0	687.0	1199.0	0.7133	0.7013	1.4146	520
540	962.8	0.0215	0.4437	0.4651	536.8	657.5	1194.3	0.7378	0.6577	1.3954	540
560	1133.4	0.0221	0.3651	0.3871	562.4	625.3	1187.7	0.7625	0.6132	1.3757	560
580	1326.2	0.0228	0.2994	0.3222	589.1	589.9	1179.0	0.7876	0.5673	1.3550	580
600	1543.2	0.0236	0.2438	0.2675	617.1	550.6	1167.7	0.8134	0.5196	1.3330	600
620	1786.9	0.0247	0.1962	0.2208	646.9	506.3	1153.2	0.8403	0.4689	1.3092	620
640	2059.9	0.0260	0.1543	0.1802	679.1	454.6	1133.7	0.8686	0.4134	1.2821	640
660	2365.7	0.0277	0.1166	0.1443	714.9	392.1	1107.0	0.8995	0.3502	1.2498	660
680	2708.6	0.0304	0.0808	0.1112	758.5	310.1	1068.5	0.9365	0.2720	1.2086	680
700	3094.3	0.0366	0.0386	0.0752	822.4	172.7	995.2	0.9901	0.1490	1.1390	700
705.5	3208.2	0.0508	0	0.0508	906.0	0	906.0	1.0612	0	1.0612	705.5

TABLE A.2 PROPERTIES OF SATURATED STEAM AND SATURATED WATER (TEMPERATURE)

EQUATION SHEET

$f = ma$

$w = mg$

$E = mc^2$

$KE = 1/2\ mv^2$

$PE = mgh$

$V_f = V_o + at$

$W = v\ \Delta P$

$\Delta E = 931\ \Delta m$

$\dot{Q} = \dot{m} C_p \Delta t$

$\dot{Q} = UA\Delta T$

$Pwr = W_f \Delta h$

$P = P_o 10^{SUR(t)}$

$P = P_o e^{t/T}$

$SUR = 25.06/T$

$SUR = 25\rho/\ell^* + (\beta - \rho)T$

$T = (\ell^*/\rho) + [(\beta - \rho)/\bar{\lambda}\rho]$

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [(\ell^*/(T K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$P = (\ell\rho V)/(3 \times 10^{10})$

$\ell = \sigma N$

$v = s/t$

$s = V_o t + 1/2\ at^2$

$a = (V_f - V_o)/t$

$w = \theta/t$

$A = \frac{\pi D^2}{4}$

$\dot{m} = V_{av} A_o$

Cycle efficiency = (Net work out)/(Energy in)

$A = \lambda N$ $\qquad A = A_o e^{-\lambda t}$

$\lambda = \ln 2/t_{1/2} = 0.693/t_{1/2}$

$t_{1/2}^{eff} = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$I = I_o e^{-\Sigma x}$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$\ell^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$I_1 d_1 = I_2 d_2$

$I_1 d_1^{\ 2} = I_2 d_2^{\ 2}$

$R/hr = (0.5\ CE)/d^2$(meters)

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
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 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

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ANSWER 5.01 (3.00)

A. 300 psia = 417.35 F
450 psia = 456.28 F (from steam tables) (.5)
456.28 - 417.35 = 38.93 F for 30 minutes (.5)
38.93 X 2 = 77.86 F/HR cool down rate (.5) (1.5)

B. -38.93 F(-1X10-4 dk/k/F) = $\frac{38.93}{38.93}$ X 10-4 dk/k (1.0)
(For grading, answer is independant of part A.)

C. Yes(.1) less negative(.4) (.5)

REFERENCE
GE REACTOR PHYSICS REVIEW, pg 26 & 28 , STEAM TABLES
DRESDEN - LESSON PLAN, BOOK 4, CHAPTER 12, PAGE 26.

ANSWER 5.02 (2.00)

a. Transition boiling may occur which can result in clad failure. (1.0)

b. To make the MCPR limit more conservative to account for the possibility of a sudden flow increase and a corresponding power increase. The MCPR is increased (or more conservative) (1.0)
("Recirc. pump runaway" acceptable for "sudden flow increase")

REFERENCE
NMP-1 Operations Technology, Mod.X, pg.X-34, Tech. Specs,pg.70-70a.

DRESDEN - Tech Spec 1.1, pg B 1/2.1-7, & 3.5K, pg B 3/4.5-37

ANSWER 5.03 (2.00)

a. EOL (0.5)
Because B eff is at its minimum value. (0.5)

b. When added reactivity exceeds B eff, prompt criticality is achieved. (1.0)

REFERENCE
Dresden Reactor Theory Lesson Plan, Book 4, Ch. 12, P. 22

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 5.04 (2.50)

A. 1. They are located as far below the normal water line as possible to provide the greatest static head.
2. With feed flow less than 20% they are kept on minimum speed.
3. At high power operation adequate NPSH is obtained from feedwater subcooling.
4. Low reactor Vessel water level trip, cavitation interlock.
5. Suction valve closed trip, cavitation interlock. (3 @ 0.5 ea)

B. ~~NPSH is the required press and temp conditions at the suction of a pump that will not result in cavitation.~~ (1.0)
NPSH is defined as the difference in pressure between the static pressure at the eye of the a pump and saturation pressure,

REFERENCE
Dresden Recirc System Lesson Plan pg 16 & 18

ANSWER 5.05 (1.50)

A. The pump will eventually add a sufficient amount of heat to the fluid to cause cavitation. (Will accept overheating of the pump.) (0.5)

B. Could cause excessively large starting currents or water hammer if the downstream piping was not filled. (0.5)

C. Causes excessive motor amps to be drawn. (0.5)

REFERENCE
DRESDEN - GE THERMO HT & FF pg 7-123, 124

ANSWER 5.06 (2.00)

A. The subcooling of condensate below the saturation temperature. (.5)

B. The condensate pumps would cavitate. (1.0)

C. Cycle efficiency would be decreased. (.5)

REFERENCE
DRESDEN - GE THERMO HT & FF, CHAP 6

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 5.07 (1.50)

A. U-235 & U-238 (.25 each) (.5)
B. Pu-239 (.5)
C. U-235 & Pu-239 (.25 each) (.5)

REFERENCE
DRESDEN - LESSON PLAN, BOOK FOUR, CHAPTER 12, PAGE 32

ANSWER 5.08 (2.00)

A. Alpha V increases power
B. Alpha T increases power
C. Alpha D decreases power
D. Alpha V decreases power [8 @ 0.25 each] (2.0)

REFERENCE
DRESDEN - GE BWR Transient Analysis

ANSWER 5.09 (1.00)

e. (1.0)

REFERENCE
DRESDEN -GE THERMO HTX & FF, pg 9-102

ANSWER 5.10 (2.00)

a.1. increase
a.2. increase
a.3. remains the same
b.1. increase
b.2. decrease
b.3. increase [6 @ 0.33 ea]

REFERENCE
NMP1 Reactor Theory, Module 1, part 12, 13, & 14

DRESDEN - Lesson Plan Book 4, Ch 12, Rx Physics Review, pg 26-35

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 5.11 (1.00)

b (1.0)

REFERENCE
NUS: Vol 3, pp 6.1-3
BRUNSWICK 1 & 2, Student Study Guide, 02-2-A
DRESDEN - LESSON PLAN BOOK FOUR, CHAPTER 12, PAGE 14.

ANSWER 5.12 (1.00)

c (1.0)

REFERENCE
BFNP: XENON & SAMARIUM LP, P.4,12
GGNS: LP OP-NP-514, p. 5-10
BRUNSWICK 1 & 2, Student Study Guide, 02-2-A.
DRESDEN - LESSON PLAN BOOK FOUR, CHAPTER 12, PAGE 45.

ANSWER 5.13 (1.00)

d (1.0)

REFERENCE
SSM BOOK 2, CH 2-A, SEC 13.7, PG 161
DRESDEN LESSON PLAN BOOK FOUR CHAPTER 12, PAGE 35

ANSWER 5.14 (2.00)

a. 4.77% (+- .48%)
b. 3.8% (+- .38%)
c. 1.0% (+- .10%)
d. 3.0% (+- .30%) [4 @ 0.5 each] (2.0)

REFERENCE
Dresden Reactor Physics Lesson Plan Book 4, Ch. 12, PP. 26-32, Figures 58-62
GGNS: OP-NP-513, OP-NP-514

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

EIH: L-RO-604; L-RO-605

ANSWER 5.15 (1.00)

70% void fraction in the core (0.5)

There is a larger % change in water volume for the same increase (3.45% vs 1.1%) [0.5]

-OR-

The voids produced at 70% VF have a larger effect on core reactivity since they are in an area of higher neutron flux [0.5]. (0.5)

REFERENCE
Dresden Reactor Physics Review Lesson Plan, Book 4, Ch. 12, P. 33

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 6.01 (3.00)

a. Instrumentation tap for measurement of core DP.
b. Pressure reference for measuring jet pump flow.
c. Input to the core spray line break detection system.
d. Input to CRD for cooling water and drive pressure DP.
[4 @ 0.75 each] (3.0)

REFERENCE
Dresden Student Text #1, Book 1, P. 7

ANSWER 6.02 (2.00)

a. The risers are provided to permit lowering the recirculation inlet nozzles [0.5] to remove them out of the active core region [0.5]. (1.0)
b. So that they do not receive a significant fast neutron exposure [0.5] which could change the mechanical properties of the materials [0.5]. (1.0)

REFERENCE
Dresden Student Text #1, Book 1, P. 13

ANSWER 6.03 (2.50)

a. Standby coolant supply system
b. Steam flow restricters
c. CRD velocity limiters
d. CRD housing supports
e. Standby liquid control system
f. Drywell nitrogen inerting [5 @ 0.5 each] (2.5)

REFERENCE
Dresden Student Text #5, Book 1, P. 5

.ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 6.04 (3.00)

a. 1. Ø to +60 in (Ø.25)
   2. Temperature compensated by a pressure signal (electrical compensation) (Ø.25)
   3. Level input to feedwater control (Ø.25)

b. 1. -60 to +60 in. (Ø.25)
   2. Heat clamp between the reference and variable leg (Ø.25)
   3. Recirc pump trips and ARI valve opening. (Ø.25)

c. 1. -70 to +330 in. (Ø.25)
   2. None (Ø.25)
   3. None (Ø.25)

d. 1. -340 to +60 in. (Ø.25)
   2. None (Ø.25)
   3. LPCI/containment spray interlock (Ø.25)

REFERENCE
Dresden Student Text #4, Book 1, PP. 3, 4, and 5

ANSWER 6.05 (1.00)

a. Increase (Ø.5)
b. None (Ø.5)

REFERENCE
Dresden Student Text #4, Book 1, PP. 15 and 16

ANSWER 6.06 (2.75)

a. 1. Low scram air header pressure (Ø.5)
   2. RPS subchannel A1, A2, A3, and B1, B2, B3 deenergized (Ø.5)
b. Anticipates control rods inserting in a random pattern as their scram valves overcome spring pressure, precludes this by dumping the air at a preset pressure. (Ø.75)
c. RPS Bus A and B (Ø.5)
d. When SDV HI-HI level scram switch is in bypass (Ø.5)

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

REFERENCE
Dresden Student Text #6, Book 1, PP. 26 and 27

ANSWER 6.07 (1.75)

LPSP Actuate
Total steam flow >/= 20% [0.25] AND [0.125] feed flow >/= 10% for at least [0.25]
60 seconds [0.125] (0.75)
Deactuate (steam flow </= 20%) [0.25] OR (feed flow </+ 10%) [0.25] (0.5)

LPAP Actuate
Total steam flow >/= 35% (0.25)
Deactuate total steam flow </= 35% (0.25)

REFERENCE
Dresden Lesson Plan #8, Book 1, P.7

ANSWER 6.08 (.75)

a. breakdown
b. bushing
c. 60 [3 @ 0.25 each] (0.75)

REFERENCE
Dresden Student Text #1, Book 2, P. 6

ANSWER 6.09 (.50)

2000 RPM (0.5)

REFERENCE
Dresden Student Text #10, Book 3, P. 35

ANSWER 6.10 (1.25)

a. Oxygen
b. IGSCC
c. Recombine
d. Hydrogen
e. Explosions [5 @ 0.25 each] (1.25)

REFERENCE
Dresden Student Text #5, Book 2, PP. 2-5

ANSWER 6.11 (2.75)

a. One channel upscale [0.25] and one channel downscale [0.25], or both channels [0.25] upscale [0.25]. (1.0)
b. 1. Off-Gas chimney Isolation valve closes. (0.5)
2. Off-Gas drain valve closes. (0.5)
3. Off-Gas pressurized drain tank is isolated from the pressurized drain pump.. (0.5)
c. 15 minutes (0.25)

REFERENCE
Dresden Student Text #1, Book 3, Page 8

ANSWER 6.12 (2.00)

a. 1. Motor Pump A MCC 28-1 (0.25)
2. Motor Pump B MCC 29-1 (0.25)
b. 480/120 AC from MCC 28-1 and 29-1 (0.5)
c. To prevent chugging [0.25]. As the reactor pressure decreased from the insertion of negative reactivity [0.25] the flow from a centrifical pump would increase [0.25], resulting in a rapid injection of boron [0.25]. (1.0)

REFERENCE
Dresden Student Text #3, Book 3, PP. 5 and 11

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 6.13 (1.00)

a.	1.	Aux electric room	(0.25)
	2.	Computer room	(0.25)
b.	1.	False	(0.25)
	2.	True	(0.25)

REFERENCE
Dresden Student Text #5, Book 4, PP. 15 and 16

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 7.01 (2.75)

1. RPV water level cannot be maintained above +8" OR cannot be determined. (0.75)
2. RPV pressure above 1060 psig. (0.5)
3. Drywell pressure above 2.0 psig (0.5)
4. A condition which requires reactor scram AND reactor power is either:
   a. above 6% (as indicated by APRM downscale lights not energized) OR
   b. Cannot be determined (1.0)

REFERENCE
Dresden DEOP 100, P. 1

ANSWER 7.02 (1.50)

a. DEOP 100-1 (Reactor Level Control)
b. DEOP 100-2 (RPV Pressure Control)
c. DEOP 100-3 (Reactor Power Control) [3 @ 0.5 each] (1.5)

REFERENCE
Dresden DEOP 100, P. 1

ANSWER 7.03 (1.50)

a. 2 Charging water valve 2(3)-03-1-25 must be closed. (0.17) ~~(0.5)~~
b. To divert flow from the charging header to the drive header. (0.75)
c. ~~High worth~~ ~~or~~ "DEEP" rods. or "CRAM ARRAYS" (0.25)

REFERENCE
Dresden DEOP 100-3, PP. 6 and 7

a.1 start both CRD pumps (0.17)

a.3 Rapidly insert all control rods using the Emergency ROD-IN control switch. (0.17)

7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 7.04 (2.00)

a. >/= 1.02
b. > 20%
c. </= 20%
d. .90

[4 @ 0.5 each] (2.0)

REFERENCE
Dresden DGP 1-1, P. 18

ANSWER 7.05 (2.00)

a. If excessive vibration is noted (> 15 mils)
b. Lower vacuum approximately 2 inches
c. Do not lower vacuum below 25"
(No greater than 5 inches of Hg back pressure.)
d. It imposes excessive loads on the turbine last stage buckets.

[4 @ 0.5 each] (2.0)

REFERENCE
Dresden DGP 2-1, P. 11

ANSWER 7.06 (2.50)

a. 1. Reactor startup
2. Rx shutdown (all rods in) or scram
3. A change of >/= 500 MWT in 1 hour [3 @ 0.5 each] (1.5)
b. 1. Notify RAD-CHEM Department of increased sampling requirements. (0.5)
2. Make the required entry in the unit Log Book. (0.5)

REFERENCE
Dresden DGP 3-1, PP. 1 and 2

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 7.07 (2.50)

a. Reactor scram
b. Group 1 isolation
c. Chimney isolation valve closure
d. Air ejector suction valve closure
e. Mechanical vacuum pump trip [5 @ 0.5 each] (2.5)

REFERENCE
Dresden DGA 16, P. 1

ANSWER 7.08 (1.50)

a. Crud burst
b. Air intrusion
c. Resin intrusion [3 @ 0.5 each] (1.5)

REFERENCE
Dresden DGA 16, P. 3

ANSWER 7.09 (1.50)

a. 1. Job completion
2. Conditions change
3. Cancellation
4. RWP expired [4 @ 0.25 each] (1.0)

b. 1. ~~24 hours~~ 1/year
2. ~~7 days~~ Length of Job. [2 @ 0.25 each] (0.5)

REFERENCE
Dresden Radiation Protection Standards, PP. 11-~~13~~/14

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 7.10 (3.00)

a. Whole Body
   - Life saving 75 rem (0.5)
   - Less urgent actions 25 rem (0.5)

b. Extremities
   - Life saving 200 rem ~~100~~ (0.5)
   - Less urgent actions ~~125~~ rem (0.5)

c. 1. 25 rem (0.5)
   2. Once in a lifetime (0.5)

REFERENCE
Dresden Radiation Protection Standards, P. 26

ANSWER 7.11 (1.00)

a. Rx power > 20% (0.5)
b. 65-100% of rated core flow (0.5)

REFERENCE
Dresden 2 Tech. Spec. 3.3.G

ANSWER 7.12 (1.50)

a. False (0.5)
b. True (0.5)
c. False (0.5)

REFERENCE
Dresden Tech. Specs. 3.3.B

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 7.13 (2.00)

a. 1. Hour
2. Vessel metal ~~water~~ Temperature
3. Water level or water temperature
4. Water temperature or water level [4 @ 0.25 each] (1.0)

b. 1. Increase SDC flow
2. Start another SDC pump
3. Start CRD pumps
4. Flood the main steam lines while draining through the main steam line drains [4 @ 0.25 each] (1.0)

REFERENCE
Dresden DOP 1000-3, P. 3

. ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 8.01 (1.00)

"At-the-controls" means the unit operator is in line of sight of the unit front panels. (1.0)

REFERENCE
Dresden DAP 7-2, P. 4

ANSWER 8.02 (3.50)

a. Shift engineers office [0.25] or the control room [0.25] (0.5)
b. 1. Review and initial the previous shift's emergency system's checklist.
2. Review previous shifts daily surveillance sheets.
3. Review the unit and center desk logs from the last date on shift or preceeding four days whichever is less.
4. Review current daily orders.
5. Review the unit equipment out-of-service log.
6. Review and verify degraded equipment log is properly filled out.
7. Walk thru unit and center desk control panels.
8. Complete the on-coming section of the shift supervisor's turnover checklist. [6 required @ 0.5 each] (3.0)

REFERENCE
Dresden DAP 702, PP. 1 and 2

ANSWER 8.03 (1.50)

a. 1. Safety evaluation checklist is completed and reviewed by TWO SRO's one of whom shall be a S.E.P. (0.5)
2. Jumper is authorized by the shift engineer. (0.5)
b. NRC approval is required prior to implementation. (0.5)

REFERENCE
Dresden DAP 7-4, PP. 2 and 6

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 8.04 (1.50)

a. 1. Locking the area except when access is required.
2. Use of an access control monitor to restrict entry.
[2 @ 0.5 each] (1.0)

b. 1. Shift Engineer
2. Shift Foreman [2 @ 0.25 each] (0.5)

REFERENCE
Dresden DAP 12-4, PP. 1 and 5

ANSWER 8.05 (1.50)

The notch override switch shall (0.5) not be used between positions 00 and 24 [0.5] until the first bypass valve is open [0.25], or the unit is on the line [0.25]. (1.5)

REFERENCE
Dresden DGP 1-4, P. 32

ANSWER 8.06 (.50)

False (0.5)

REFERENCE
Dresden DGP 2-3, P. 7

ANSWER 8.07 (2.00)

a. Unit 3 60%
Unit 2 43% [2 @ 0.5 each] (1.0)

b. Inadequate jet pump riser in Unit 2 which causes large jet pump vibrations during single loop operation. (1.0)

REFERENCE
Dresden DOA 202-1, PP. 1 and 4

·ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 8.08 (3.00)

a. Unit startup.
   1. During the time period just prior to placing the reactor mode switch in the run position until the beginning of the 12 hour xenon soak. (0.75)
   2. During the time period between the end of the 12 hour xenon soak and the placement of the unit on the 5 MWe/hr ramp rate. (0.75)

b. Unit shutdown
   1. From the initial load drop with recirculation flow to placing the reactor mode switch to startup. (0.75)
   2. Any anticipated power change (increase or decrease of greater than 150 MWe within an 8 hour time period. (0.75)

REFERENCE
Dresden Operating Order #5-86

ANSWER 8.09 (1.00)

1. Notify the operating engineer on duty supervisor. (0.5)
2. Notify NRC Region III (0.5)

REFERENCE
Dresden Operating Order #25-86

ANSWER 8.10 (3.25)

a. MCPR < 1.06 GE 8x8R or 1.05 ENC and GE 8x8 fuel
   With Rx pressure > 800 psig and
   core flow > 10% of rated. (1.0)
b. Core thermal power shall not exceed 25% of rated when reactor pressure is less than 800 psig or core flow < 10% of rated. (0.75)
c. Neutron flux shall not exceed the scram setting for longer than 1.5 seconds as indicated by the process computer. (0.75)
d. With irradiated fuel in the reactor, the water level shall not be less than 12 inches above the top of the active fuel. (0.75)

REFERENCE
Dresden Tech Specs 1.1 A thru D

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 8.11 (1.50)

Reactor shall be shutdown immediately and shall not be resumed until authorized by the NRC [0.5] report shall be promptly made to the Division V-P Nuclear Stations [0.5] and the NRC operations center as soon as possible within one hour [0.5]. (1.5)

REFERENCE
Dresden Tech Specs 6.4, P. 6-16

ANSWER 8.12 (2.25)

a. 1. 2
   2. 1
   3. 3
   4. 5
   5. 1
   [5 @ 0.25 each] (1.25)

b. Shift crew composition may be less than the minimum requirements for a period of time not exceed 2 hours in order to accommodate unexpected absence provided immediate action is taken to restore the composition to within the minimum requirements. (1.0)

REFERENCE
Dresden Tech. Specs. Table 6.11, P. 6.5

ANSWER 8.13 (2.50)

a. The intent of the original procedure is not altered. (0.5)
b. The change is approved by two members of the plant management staff at least one of whem holds an SRO license on the unit affected. (1.0)
c. The change is documented, reviewed by the onsite review and invesitgative function and approval by the station superintendent within 14 days of implementation. (1.0)

REFERENCE
Dresden Tech Spec's 6.0D, P. 6-16

ANSWER 8.14 (1.00)

a. 5 (0.5)
b. Quarterly (0.5)

REFERENCE
Dresden Tech Spec's 6.1E, P. 6.1

ANSWER 8.15 (1.00)

a. Take action to restore it within 15 minutes. (0.5)
b. Two hours (0.5)

REFERENCE
DRESDEN - TECHNICAL SPECIFICATIONS, 3.5I, page 3/4.5-15

U. S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

FACILITY: DRESDEN 2&3

REACTOR TYPE: BWR-GE3

MASTER COPY

DATE ADMINISTERED: 86/06/24

EXAMINER: HANEK, J.

APPLICANT: _____

INSTRUCTIONS TO APPLICANT:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses 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	APPLICANT'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.50	24.76	_____	_____	1. PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW
24.75	24.03	_____	_____	2. PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS
26.75	25.97	_____	_____	3. INSTRUMENTS AND CONTROLS
26.00	25.24	_____	_____	4. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
103.00	100.00	_____	_____	TOTALS

FINAL GRADE _____%

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

_____
APPLICANT'S SIGNATURE

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

1. Cheating on the examination means an automatic denial of your application and could result in more severe penalties.

2. Restroom trips are to be limited and only one candidate at a time may leave. You must avoid all contacts with anyone outside the examination room to avoid even the appearance or possibility of cheating.

3. Use black ink or dark pencil only to facilitate legible reproductions.

4. Print your name in the blank provided on the cover sheet of the examination.

5. Fill in the date on the cover sheet of the examination (if necessary).

6. Use only the paper provided for answers.

7. Print your name in the upper right-hand corner of the first page of each section of the answer sheet.

8. Consecutively number each answer sheet, write "End of Category __" as appropriate, start each category on a new page, write only one side of the paper, and write "Last Page" on the last answer sheet.

9. Number each answer as to category and number, for example, 1.4, 6.3.

10. Skip at least three lines between each answer.

11. Separate answer sheets from pad and place finished answer sheets face down on your desk or table.

12. Use abbreviations only if they are commonly used in facility literature.

13. The point value for each question is indicated in parentheses after the question and can be used as a guide for the depth of answer required.

14. Show all calculations, methods, or assumptions used to obtain an answer to mathematical problems whether indicated in the question or not.

15. Partial credit may be given. Therefore, ANSWER ALL PARTS OF THE QUESTION AND DO NOT LEAVE ANY ANSWER BLANK.

16. If parts of the examination are not clear as to intent, ask questions of the examiner only.

17. You must sign the statement on the cover sheet that indicates that the work is your own and you have not received or been given assistance in completing the examination. This must be done after the examination has been completed.

18. When you complete your examination, you shall:

    a. Assemble your examination as follows:

        (1) Exam questions on top.

        (2) Exam aids - figures, tables, etc.

        (3) Answer pages including figures which are a part of the answer.

    b. Turn in your copy of the examination and all pages used to answer the examination questions.

    c. Turn in all scrap paper and the balance of the paper that you did not use for answering the questions.

    d. Leave the examination area, as defined by the examiner. If after leaving, you are found in this area while the examination is still in progress, your license may be denied or revoked.

QUESTION 1.01 (1.00)

In a subcritical reactor, Keff is increased from .880 to .965. Which of the following is the amount of reactivity added to the core?

a. .085 delta k / k

b. .100 delta k / k

c. .125 delta k / k

d. .220 delta k / k

QUESTION 1.02 (1.00)

The reactor trips from full power, equilibrium XENON conditions. Twenty-four hours later the reactor is brought critical and power level is maintained on range 5 of the IRMs for several hours. Which of the following statements is CORRECT concerning control rod motion?

a. Rods will have to be withdrawn due to XENON build-in.

b. Rods will have to be rapidly inserted since the critical reactor will cause a high rate of XENON burnout.

c. Rods will have to be inserted since XENON will closely follow its normal decay rate.

d. Rods will approximately remain as is as the XENON establishes its equilibrium value for this power level.

(***** CATEGORY 01 CONTINUED ON NEXT PAGE *****)

QUESTION 1.03 (1.00)

Concerning control rod worths during a reactor startup from 100% PEAK XENON versus a startup under XENON-FREE conditions, which statement is correct? (1.0)

a. BOTH control rod worths will be LOWER regardless of core XENON conditions.

b. CENTRAL control rod worth will be HIGHER during the PEAK XENON startup than during the XENON-FREE startup.

c. BOTH control rod worths will be the SAME regardless of core Xenon conditions.

d. PERIPHERAL control rod worth will be HIGHER during the PEAK XENON startup than during the XENON-FREE startup.

QUESTION 1.04 (3.00)

The reactor is shutdown and a plant cooldown is in progress. Reactor pressure decreases from 450 psia to 300 psia in a 30 minute period. SHOW ALL WORK.

A. What is the cooldown rate? (1.5)

B. How much reactivity has been inserted in the rector due to the moderator temperature coefficient (MTC)? (1.0)

C. With the above temperature change, has the MAGNITUDE of the MTC changed and if so, in what direction (more/less, positive/negative)? (.5)

QUESTION 1.05 (2.00)

Regarding MCPR (Minimum Critical Power Ratio):

a. What PHENOMENON could exist in a fuel fundle if it were operated at a MCPR LESS THAN ONE (< 1.0) and WHAT would very likely be the CONSEQUENCE of the phenomenon? (1.0)

b. When core flow is LESS THAN RATED, is MCPR increased or decreased. (1.0)

(***** CATEGORY 01 CONTINUED ON NEXT PAGE *****)

QUESTION 1.06 (2.00)

a. Which time in core life (BOL, Mid-of-life, or EOL) requires the least amount of positive reactivity addition to achieve prompt critical AND why?

b. What is the definition of prompt critical?

QUESTION 1.07 (2.50)

A. What are THREE of the FIVE design or operational factors that insure adequate Net Positive Suction Head (NPSH) for the recirculation pumps? (1.5)

B. Briefly, explain what NPSH is. (1.0)

QUESTION 1.08 (1.50)

Give ONE undesirable result for each of the following.(Be more specific than "pump failure"):

A. Operating a centrifugal pump for extended periods of time with the discharge valve shut. (0.5)

B. Starting a centrifugal pump with the discharge valve full open. (0.5)

C. Operating a motor driven pump under "PUMP RUNOUT" conditions. (0.5)

QUESTION 1.09 (2.00)

A. DEFINE "Condensate Depression". (.5)

B. WHY is it necessary for plants to operate with condensate depression? (1.0)

C. HOW would CYCLE EFFICIENCY be effected if the amount of condensate depression is increased? (.5)

(***** CATEGORY 01 CONTINUED ON NEXT PAGE *****)

QUESTION 1.10 (1.50)

In a reactor fueled with U-235 and U-238:

A. Which nuclide(s) may fission upon absorbing a fast neutron? (.5)

B. What fissile nuclide can U-238 be converted into? (.5)

C. At the Middle of Core Life (MOL), which 2 nuclides will absorb a thermal neutron and fission? (.5)

QUESTION 1.11 (2.00)

For the following transients, indicate which COEFFICIENT of reactivity; alpha T, alpha D, or alpha V tends to change reactor power FIRST and in what DIRECTION.

A. Fast closure of one MSIV. (0.5)
B. Isolation of a feedwater heater string. (0.5)
C. A control rod drop. (0.5)
D. Relief valve lifting. (0.5)

QUESTION 1.12 (2.00)

A significant amount of excess reactivity must be loaded into a core at BOL so that 100% power can be attained at the end of a fuel cycle. For each of the following, LIST the approximate value of K-excess which must be loaded to overcome that negative reactivity component at rated-equilibrium conditions.

a. Moderator temp increase

b. Void fraction increase

c. Samarium buildup

d. Xenon buildup

(***** CATEGORY 01 CONTINUED ON NEXT PAGE *****)

QUESTION 1.13 (1.00)

STATE for which condition the reactivity coefficient contribution would be MORE NEGATIVE. EXPLAIN your choice.

Moderator Void Coefficient for a 1% INCREASE in void fraction at 10% void fraction in the core,

-OR-

Moderator void coefficient for a 1% INCREASE in void fraction at 70% void fraction in the core.

QUESTION 1.14 (1.00)

The 8x8 fuel has a thermal time constant of approximately 5 to 6 seconds. This means that in 5 to 6 seconds following a sudden power increase: (choose ONE answer below) (1.0)

a. The fuel centerline temperature will reach its maximum (final) value.

b. Clad surface temperature will reach its final value.

c. Fuel centerline temperature will reach approximately 2/3 of its final value.

d. Fuel centerline, clad and coolant temperature have reached their final values.

e. Clad surface temperature will reach approximately 63% of its final value.

QUESTION 1.15 (2.00)

Indicate HOW each of the coefficients are effected [Increase, Decrease or Remain the same] by each of the three parameters listed? Consider each parameter separately.

a. Rod Worth (delta K/K/Bank) by:
   1. Moderator temperature INCREASES
   2. Voids DECREASE
   3. Fuel temperature INCREASES [3 @ 0.33 ea]

b. Alpha Voids (delta K/K/ % voids) by:
   1. Fuel temperature INCREASES
   2. Core age INCREASES
   3. Control Rod Density INCREASES [3 @ 0.33 ea]

(***** END OF CATEGORY 01 *****)

QUESTION 2.01 (1.50)

Other than floor drains, list THREE inputs to the reactor building floor drain sump.

QUESTION 2.02 (3.00)

a. Other than the Instrument Air Dryers, list FOUR components where moisture is removed from the Instrument Air System. (2.0)

b. Where do the service air and Unit 3 cross-ties tap into the Unit 2 Instrument Air System. (Upstream or downstream of a major component required as a reference.) (1.0)

QUESTION 2.03 (.50)

A downscale trip on an area radiation monitor could be an indication of which of the following: (CHOOSE ONE ONLY)

a. Low background in the area of the detector.

b. Instrument failure.

c. A saturated G-M tube from a very high radiation level.

QUESTION 2.04 (2.00)

Concerning the fuel pool cooling filter demin bypass valve (1901-40), list TWO purposes of this valve that require it to be open.

QUESTION 2.05 (1.50)

List THREE functions provided by the RWCU system taking a suction on the reactor vessel lower head.

(***** CATEGORY 02 CONTINUED ON NEXT PAGE *****)

QUESTION 2.06 (2.75)

a. List THREE signals that will cause a HPCI (Group IV) isolation. Include applicable setpoints. (1.5)

b. If the HPCI turbine is running when the Group IV signal is received, what actions will occur. (1.25)

QUESTION 2.07 (3.25)

a. What conditions are required for automatic ADS initiation (include setpoints). (2.25)

b. What signal(s) will actuate the solenoids for the electromatic relief valves if the control switch is the following positions. (1.0)

1. Off
2. Manual
3. Automatic

QUESTION 2.08 (2.75)

a. The isolation condenser will actuate at a.1._____ psig after a a.2._____ time delay. (1.0)

b. What is the function of the time delay and what would be the effects if it were not used? (1.0)

c. List THREE sources of shell side makeup water (primary and backup). (0.75)

QUESTION 2.09 (2.00)

a. Why are risers utilized on the jet pumps?

b. What would be the detrimental effects of not utilizing risers?

(***** CATEGORY 02 CONTINUED ON NEXT PAGE *****)

QUESTION 2.10 (2.00)

Concerning the Standby Liquid Control Pumps.

a. What is the power supply(s) to the pump motors? (0.5)

b. What is the power voltage and supply to the squib valves? (0.5)

c. Briefly, explain why positive displacement pumps are utilized instead of centrifical pumps. (1.0)

QUESTION 2.11 (1.00)

There are TWO sets of vacuum breakers associated with the containment system. Provide the following information on each set.

a. Setpoint

b. Normal position DURING a LOCA

c. Safety actuation flow path

QUESTION 2.12 (2.50)

Other than the Emergency Core Cooling Systems, list FIVE of the SIX systems or components that constitute the engineered safeguards at Dresden.

(***** END OF CATEGORY 02 *****)

QUESTION 3.01 (2.75)

a. The recirc pump speed control mismatch circuitry prevents exceeding a ___a.___ speed mismatch between the two recirc pumps. (0.25)

b. What is the primary and secondary reason speed mismatch is limited? (1.0)

c. What protective function occurs if the mismatch exceeds the limits established in a. above? (0.5)

d. Under what conditions will the circuit trip a recirc pump? (0.5)

e. What function (associated with mismatch) allows restart of an idle recirc pump? (0.5)

QUESTION 3.02 (2.50)

a. If the plant is operating with one main steam line isolated, why is the main steam line rad monitor for that line considered operable? (0.75)

b. What type of detectors are the main steam line rad monitors? (0.5)

c. What is the main source of the background reading when at power? (0.5)

d. Why is the background reading different for Unit 2 and 3? (0.5)

e. Is the downscale alarm a valid indication of instrument failure when at very low power levels (not in run)? (0.25)

QUESTION 3.03 (2.50)

List FIVE of the SIX conditions that must be met for an auto start of a standby feed pump. (include applicable setpoints.)

(***** CATEGORY 03 CONTINUED ON NEXT PAGE *****)

QUESTION 3.04 (3.00)

For each of the below listed vessel level indications, provide the following

1. Range
2. Method of temperature compensation (if any)
3. Major control functions besides indication and alarm (if any).

a. Narrow Range GE/MAC

b. ATWS Level Transmitter

c. Wide Range GE/MAC (Floodup)

d. Wide Range Yarway (Fuel Zone)

QUESTION 3.05 (1.75)

With respect to the RWM, what signal(s) are utilized to actuate and deactuate the LPSP and LPAP (include applicable setpoints and times).

QUESTION 3.06 (2.75)

The Off-Gas HI-HI Radiation Trip logic will initiate on TWO conditions.

a. What are these conditions? (1.0)

b. List THREE auto actions that will result from a trip condition following timeout of the Timer. (1.5)

c. What is the setting of the Timer? (0.25)

QUESTION 3.07 (.50)

Following an auto initiation of HPCI, the low pressure sensing line from the HPCI flow element (FE-2-2356) ruptures. (Assume 1000 psig Rx pressure.)

After rupture, what would be the HPCI turbine speed assuming no operator action?

(***** CATEGORY 03 CONTINUED ON NEXT PAGE *****)

QUESTION 3.08 (1.00)

With respect to the Narrow Range Yarway instrument, what affect will the following have on indicated level

a. Increase in Drywell Temperature
b. Increase in Reactor Building Temperature near the Instrument Rack.

QUESTION 3.09 (2.00)

Briefly, explain how the feedwater regulating bypass valve "Runout" control functions. Refer to attached Figure 1.

QUESTION 3.10 (2.00)

Explain how each of the following components in the feedwater regulating valve control circuit function if a lockout signal is received. Refer to attached Figure 2.

a. Pressure switch
b. Soleniod operated pilot valve
c. Air dump valve
d. Air lock valves

QUESTION 3.11 (2.00)

List FOUR events/signals which occur (in order) as EHC oil pressure decreases from 1600 psig to 500 psig. (Setpoints not required.)

QUESTION 3.12 (2.00)

a. While operating at 100% power a "Stator Cooling Pumps Auto Trip" annunciator is received. What automatic action will occur as a result of this alarm? (Confine your answer to the turbine affects only.)

b. What action is required to restart the stator cooling pumps?

(***** CATEGORY 03 CONTINUED ON NEXT PAGE *****)

QUESTION 3.13 (2.00)

A 4kv breaker has neither red or blue lights illuminated, the control switch is not in pull to lock and the bulbs checkout good. List TWO probable causes of this condition and the results.

(***** END OF CATEGORY 03 *****)

QUESTION 4.01 (.50)

Loss of cooling water to a recirculation pump requires pump shutdown within ___1.___ to avoid pump ___2.___ damage.

QUESTION 4.02 (2.50)

List FIVE automatic actions initiated by a main steam line High Radiation Alarm at 3 X normal.

QUESTION 4.03 (2.00)

While the plant is in shutdown cooling with the reactor recirculation pumps not running surveillance of the vessel metal temperature recorder is required at least once per a.1._____. Stratification is indicated by an increasing a.2._____ temperature without a corresponding a.3._____ or a.4._____ change.

a. List parameters a.1. through a.4.

b. If the RWCU system is not available and both recirc pumps are off, list FOUR suggested actions to minimize stratification.

QUESTION 4.04 (2.00)

DOA 202-1, recirculation pump trip requires the operator to reduce the speed of the running recirc pump.

a. What are the limits for each unit at Dresden?

b. What is the reason for this difference?

QUESTION 4.05 (1.50)

Attachment A to DGP 1-1 gives special precautions to prevent a short period event.

After reaching a black and white pattern, what restrictions apply?

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.06 (1.00)

DAP 7-2 specifies that a licensed operator or senior licensed operator shall be "at-the-controls" at all times.

What is the meaning of "at-the-controls"?

QUESTION 4.07 (1.00)

List TWO conditions that must be met prior to placing the economic generation control system in operation with automatic flow control.

QUESTION 4.08 (.50)

When may seal purge flow be established during a recirc system startup per DO 202-1?

QUESTION 4.09 (1.00)

A coupling check is performed when withdrawing control rods to position 48.

a. EXPLAIN HOW this coupling check is performed. (0.5)

b. WHAT indication would tell the operator the rod was uncoupled? (0.5)

QUESTION 4.10 (.75)

While performing a reactor startup, the SRM's are withdrawn to maintain greater than ___1.___ cps and less than ___2.___ cps until the IRM's are on range ___3.___ or above. Failure to maintain these limits will result in a rod block.

QUESTION 4.11 (2.50)

Other than a decreasing neutron flux, list FIVE other check's the operator can make to assure Standby Liquid Control is injecting.

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.12 (1.25)

a. In reference to the Dresden II Tech. Specs. for the primary containment, the suppression pool water temperature shall not exceed ___a.1.___ during normal power operation. During testing which adds heat to the suppression pool, the pool temperature shall not exceed ___a.2.___ and must be observed and logged every ___a.3.___ minutes until the heat addition is terminated. (0.75)

b. What is the maximum suppression pool temperature allowed during reactor operation? (0.25)

c. What action is taken if it exceeds this maximum temperature during operation? (0.25)

QUESTION 4.13 (2.00)

Tech. Specs. discuss that the preferred method utilized to disarm a CRD is electrically.

a. How is this action performed?

b. List TWO reasons why this is the preferred method?

QUESTION 4.14 (1.00)

What would be the expected whole body dose rate for each of the following areas at Dresden?

a. Radiation Area

b. High Radiation Area

QUESTION 4.15 (1.50)

What are the quarterly exposure limits established by the NRC for the following: (Assume NRC-Form 4 completed.)

a. Whole body

b. Skin of whole body

c. Hands, forearms, feet, and ankles

(***** CATEGORY 04 CONTINUED ON NEXT PAGE *****)

QUESTION 4.16 (1.00)

Answer the following TRUE or FALSE.

a. At least one IRM must be in service in the core quadrant where refueling is taking place.

b. An SRM detector is considered inoperable if it has less than 3 cps under any conditions.

QUESTION 4.17 (2.50)

When paralleling electrical sources, the synchroscope should be rotating ___1.___ in the ___2.___ direction and ___3.___ voltage should be slightly ___4.___ than the ___5.___ voltage.

QUESTION 4.18 (1.50)

While increasing load on the main generator, what controls are used to adjust the following:

a. Main Generator VARS

b. Amplidyne AVR Balance

(***** END OF CATEGORY 04 *****)

(********** END OF EXAMINATION **********)

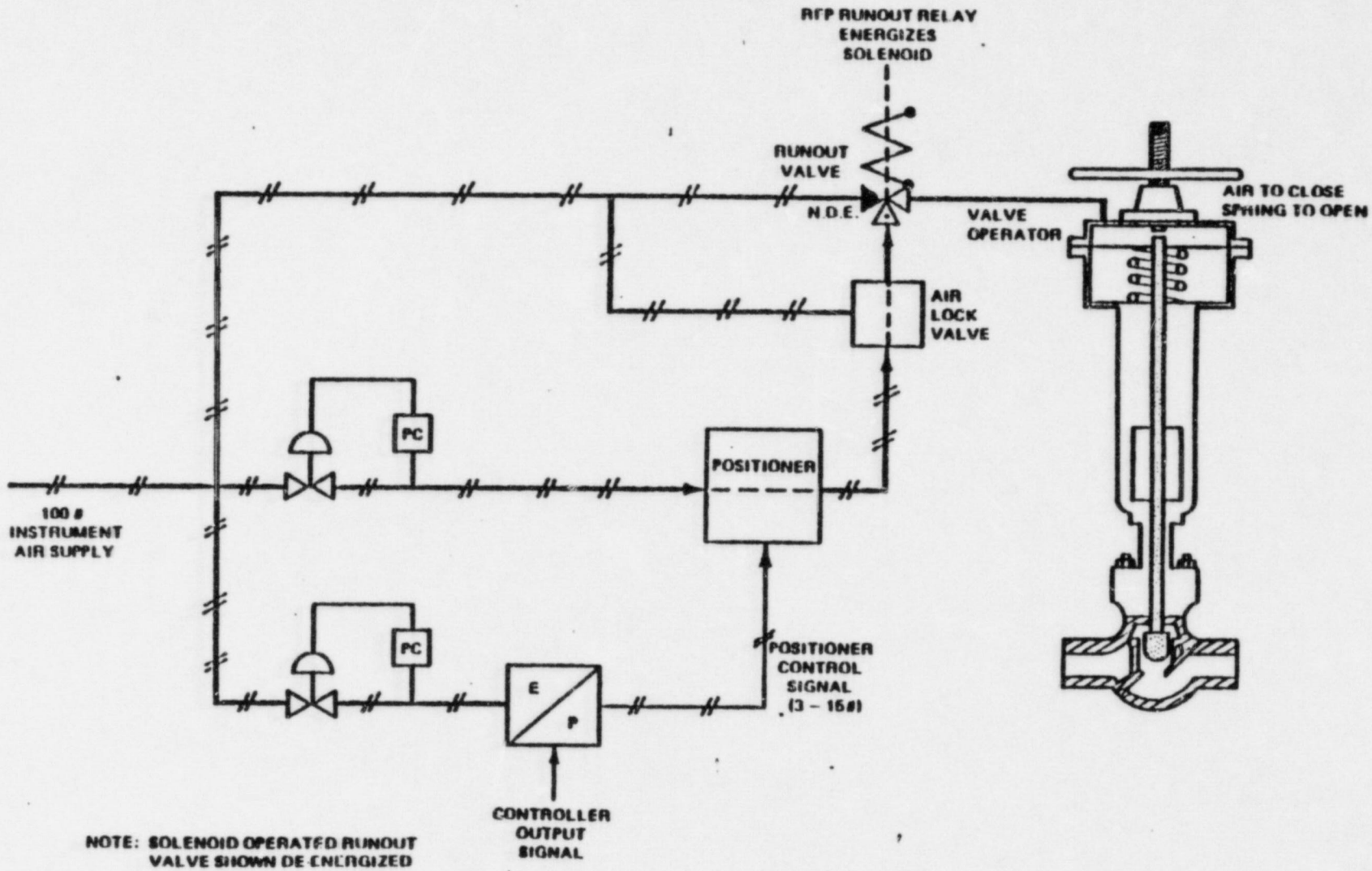

Figure | Feedwater Regulating Bypass Valve Control

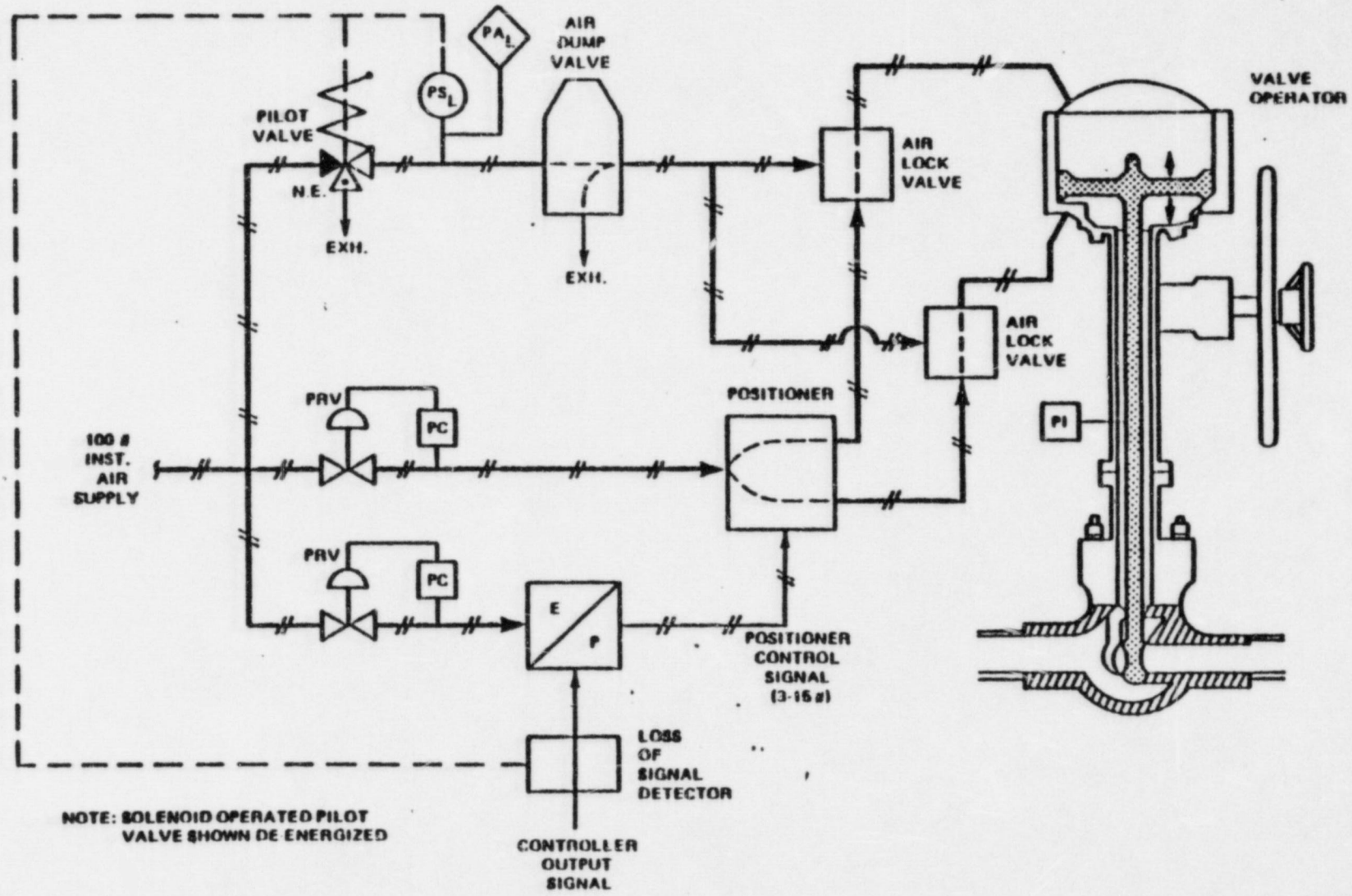

Figure 1 Feedwater Regulating Valve Control

Temp F	Press. psia	Volume, ft³/lb			Enthalpy, Btu/lb			Entropy, Btu/lb x F			Temp F
		Water v_f	Evap v_{fg}	Steam v_g	Water h_f	Evap h_{fg}	Steam h_g	Water s_f	Evap s_{fg}	Steam s_g	
32	0.08859	0.01602	3305	3305	-0.02	1075.5	1075.5	0.0000	2.1873	2.1873	32
35	0.09991	0.01602	2948	2948	3.00	1073.8	1076.8	0.0061	2.1706	2.1767	35
40	0.12163	0.01602	2446	2446	8.03	1071.0	1079.0	0.0162	2.1432	2.1594	40
45	0.14744	0.01602	2037.7	2037.8	13.04	1068.1	1081.2	0.0262	2.1164	2.1426	45
50	0.17795	0.01602	1704.8	1704.8	18.05	1065.3	1083.4	0.0361	2.0901	2.1262	50
60	0.2561	0.01603	1207.6	1207.6	28.06	1059.7	1087.7	0.0555	2.0391	2.0946	60
70	0.3629	0.01605	868.3	868.4	38.05	1054.0	1092.1	0.0745	1.9900	2.0645	70
80	0.5068	0.01607	633.3	633.3	48.04	1048.4	1096.4	0.0932	1.9426	2.0359	80
90	0.6981	0.01610	468.1	468.1	58.02	1042.7	1100.8	0.1115	1.8970	2.0086	90
100	0.9492	0.01613	350.4	350.4	68.00	1037.1	1105.1	0.1295	1.8530	1.9825	100
110	1.2750	0.01617	265.4	265.4	77.98	1031.4	1109.3	0.1472	1.8105	1.9577	110
120	1.6927	0.01620	203.25	203.26	87.97	1025.6	1113.6	0.1646	1.7693	1.9339	120
130	2.2230	0.01625	157.32	157.33	97.96	1019.8	1117.8	0.1817	1.7295	1.9112	130
140	2.8892	0.01629	122.98	123.00	107.95	1014.0	1122.0	0.1985	1.6910	1.8895	140
150	3.718	0.01634	97.05	97.07	117.95	1008.2	1126.1	0.2150	1.6536	1.8686	150
160	4.741	0.01640	77.27	77.29	127.96	1002.2	1130.2	0.2313	1.6174	1.8487	160
170	5.993	0.01645	62.04	62.06	137.97	996.2	1134.2	0.2473	1.5822	1.8295	170
180	7.511	0.01651	50.21	50.22	148.00	990.2	1138.2	0.2631	1.5480	1.8111	180
190	9.340	0.01657	40.94	40.96	158.04	984.1	1142.1	0.2787	1.5148	1.7934	190
200	11.526	0.01664	33.62	33.64	168.09	977.9	1146.0	0.2940	1.4824	1.7764	200
210	14.123	0.01671	27.80	27.82	178.15	971.6	1149.7	0.3091	1.4509	1.7600	210
212	14.696	0.01672	26.78	26.80	180.17	970.3	1150.5	0.3121	1.4447	1.7568	212
220	17.186	0.01678	23.13	23.15	188.23	965.2	1153.4	0.3241	1.4201	1.7442	220
230	20.779	0.01685	19.364	19.381	198.33	958.7	1157.1	0.3388	1.3902	1.7290	230
240	24.968	0.01693	16.304	16.321	208.45	952.1	1160.6	0.3533	1.3609	1.7142	240
250	29.825	0.01701	13.802	13.819	218.59	945.4	1164.0	0.3677	1.3323	1.7000	250
260	35.427	0.01709	11.745	11.762	228.76	938.6	1167.4	0.3819	1.3043	1.6862	260
270	41.856	0.01718	10.042	10.060	238.95	931.7	1170.6	0.3960	1.2769	1.6729	270
280	49.200	0.01726	8.627	8.644	249.17	924.6	1173.8	0.4098	1.2501	1.6599	280
290	57.550	0.01736	7.443	7.460	259.4	917.4	1176.8	0.4236	1.2238	1.6473	290
300	67.005	0.01745	6.448	6.466	269.7	910.0	1179.7	0.4372	1.1979	1.6351	300
310	77.67	0.01755	5.609	5.626	280.0	902.5	1182.5	0.4506	1.1726	1.6232	310
320	89.64	0.01766	4.896	4.914	290.4	894.8	1185.2	0.4640	1.1477	1.6116	320
340	117.99	0.01787	3.770	3.788	311.3	878.8	1190.1	0.4902	1.0990	1.5892	340
360	153.01	0.01811	2.939	2.957	332.3	862.1	1194.4	0.5161	1.0517	1.5678	360
380	195.73	0.01836	2.317	2.335	353.6	844.5	1198.0	0.5416	1.0057	1.5473	380
400	247.26	0.01864	1.8444	1.8630	375.1	825.9	1201.0	0.5667	0.9607	1.5274	400
420	308.78	0.01694	1.4808	1.4997	396.9	806.2	1203.1	0.5915	0.9165	1.5080	420
440	381.54	0.01926	1.1976	1.2169	419.0	785.4	1204.4	0.6161	0.8729	1.4890	440
460	466.9	0.0196	0.9746	0.9942	441.5	763.2	1204.8	0.6405	0.8299	1.4704	460
480	566.2	0.0200	0.7972	0.8172	464.5	739.6	1204.1	0.6648	0.7871	1.4516	480
500	680.9	0.0204	0.6545	0.6749	487.9	714.3	1202.2	0.6890	0.7443	1.4333	500
520	812.5	0.0209	0.5386	0.5596	512.0	687.0	1199.0	0.7133	0.7013	1.4146	520
540	962.8	0.0215	0.4437	0.4651	536.8	657.5	1194.3	0.7378	0.6577	1.3954	540
560	1133.4	0.0221	0.3651	0.3871	562.4	625.3	1187.7	0.7625	0.6132	1.3757	560
580	1326.2	0.0228	0.2994	0.3222	589.1	589.9	1179.0	0.7876	0.5673	1.3550	580
600	1543.2	0.0236	0.2438	0.2675	617.1	550.6	1167.7	0.8134	0.5196	1.3330	600
620	1786.9	0.0247	0.1962	0.2208	646.9	506.3	1153.2	0.8403	0.4689	1.3092	620
640	2059.9	0.0260	0.1543	0.1802	679.1	454.6	1133.7	0.8686	0.4134	1.2821	640
660	2365.7	0.0277	0.1166	0.1443	714.9	392.1	1107.0	0.8995	0.3502	1.2498	660
680	2708.6	0.0304	0.0808	0.1112	758.5	310.1	1068.5	0.9365	0.2720	1.2086	680
700	3094.3	0.0366	0.0386	0.0752	822.4	172.7	995.2	0.9901	0.1490	1.1390	700
705.5	3208.2	0.0508	0	0.0508	906.0	0	906.0	1.0612	0	1.0612	705.5

TABLE A.2 PROPERTIES OF SATURATED STEAM AND SATURATED WATER (TEMPERATURE)

EQUATION SHEET

$f = ma$

$v = s/t$

Cycle efficiency = (Net work out)/(Energy in)

$w = mg$

$s = V_o t + 1/2\ at^2$

$E = mc^2$

$KE = 1/2\ mv^2$

$a = (V_f - V_o)/t$

$A = \lambda N \qquad A = A_o e^{-\lambda t}$

$PE = mgh$

$w = \theta/t$

$\lambda = \ln 2/t_{1/2} = 0.693/t_{1/2}$

$V_f = V_o + at$

$A = \frac{\pi D^2}{4}$

$t_{1/2}^{eff} = \frac{[(t_{1/2})(t_b)]}{[(t_{1/2}) + (t_b)]}$

$W = v\ \Delta P$

$\dot{m} = V_{av} A_o$

$I = I_o e^{-\Sigma x}$

$\Delta E = 931\ \Delta m$

$\dot{Q} = \dot{m} C_p \Delta t$

$\dot{Q} = UA\Delta T$

$Pwr = w_f \Delta h$

$I = I_o e^{-\mu x}$

$I = I_o\ 10^{-x/TVL}$

$TVL = 1.3/\mu$

$HVL = -0.693/\mu$

$P = P_o 10^{SUR(t)}$

$P = P_o e^{t/T}$

$SUR = 26.06/T$

$SCR = S/(1 - K_{eff})$

$CR_x = S/(1 - K_{effx})$

$CR_1(1 - K_{eff1}) = CR_2(1 - K_{eff2})$

$SUR = 26\rho/t^* + (\beta - \rho)T$

$M = 1/(1 - K_{eff}) = CR_1/CR_o$

$M = (1 - K_{effo})/(1 - K_{eff1})$

$SDM = (1 - K_{eff})/K_{eff}$

$t^* = 10^{-4}$ seconds

$\bar{\lambda} = 0.1$ seconds^{-1}

$T = (t^*/\rho) + [(\beta - \rho)/\bar{\lambda}\rho]$

$T = \ell/(\rho - \beta)$

$T = (\beta - \rho)/(\bar{\lambda}\rho)$

$\rho = (K_{eff} - 1)/K_{eff} = \Delta K_{eff}/K_{eff}$

$\rho = [(t^*/(T K_{eff})] + [\bar{\beta}_{eff}/(1 + \bar{\lambda}T)]$

$P = (t\Sigma V)/(3 \times 10^{10})$

$t = \sigma N$

$I_1 d_1 = I_2 d_2$

$I_1 d_1^{\ 2} = I_2 d_2^{\ 2}$

$R/hr = (0.5\ CE)/d^2 (meters)$

$R/hr = 6\ CE/d^2$ (feet)

Water Parameters

1 gal. = 8.345 lbm.
1 gal. = 3.78 liters
1 ft^3 = 7.48 gal.
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 psi = 29.9 in. Hg.
1 ft. H_2O = 0.4335 lbf/in.

Miscellaneous Conversions

1 curie = 3.7×10^{10} dps
1 kg = 2.21 lbm
1 hp = 2.54×10^3 Btu/hr
1 mw = 3.41×10^6 Btu/hr
1 in = 2.54 cm
°F = 9/5°C + 32
°C = 5/9 (°F-32)
1 BTU = 778 ft-lbf

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

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ANSWER 1.01 (1.00)

b (1.0)

REFERENCE
NUS: Vol 3, pp 6.1-3
BRUNSWICK 1 & 2, Student Study Guide, 02-2-A
DRESDEN - LESSON PLAN BOOK FOUR, CHAPTER 12, PAGE 14.

ANSWER 1.02 (1.00)

c (1.0)

REFERENCE
BFNP: XENON & SAMARIUM LP, P.4,12
GGNS: LP OP-NP-514, p. 5-10
BRUNSWICK 1 & 2, Student Study Guide, 02-2-A.
DRESDEN - LESSON PLAN BOOK FOUR, CHAPTER 12, PAGE 45.

ANSWER 1.03 (00)

d (1.0)

REFERENCE
SSM BOOK 2, CH 2-A, SEC 13.7, PG 161
DRESDEN LESSON PLAN BOOK FOUR CHAPTER 12, PAGE 35

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 1.04 (3.00)

A. 300 psia = 417.35 F
450 psia = 456.28 F (from steam tables) (.5)
456.28 - 417.35 = 38.93 F for 30 minutes (.5)
38.93 X 2 = 77.86 F/HR cool down rate (.5) (1.5)

B. -38.93 F(-1X10-4 dk/k/F) = 38.93 X 10-4 dk/k (1.0)
(For grading, answer is independant of part A.)

C. Yes(.1) less negative(.4) (.5)

REFERENCE
GE REACTOR PHYSICS REVIEW, pg 26 & 28 , STEAM TABLES
DRESDEN - LESSON PLAN, BOOK 4, CHAPTER 12, PAGE 26.

ANSWER 1.05 (2.00)

a. Transition boiling may occur which can result in clad failure. (1.0)

b. The MCPR is increased (or more conservative). (1.0)
("Recirc. pump runaway" acceptable for "sudden flow increase")

REFERENCE
NMP-1 Operations Technology, Mod.X, pg.X-34, Tech. Specs,pg.70-70a.

DRESDEN - Tech Spec 3.1, pg B 1/2.1-7, & 3.5K, pg B 3/4.5-37

ANSWER 1.06 (2.00)

a. EOL (0.5)
Because B eff is at its minimum value. (0.5)

b. ~~When added reactivity exceeds B eff,~~ prompt critical~~ity~~ is ~~achieved~~. the condition in which the reactor is not dependent on delayed neutrons (1.0)

REFERENCE
DRESDEN REACTOR THEORY LESSON PLAN BOOK 4 CHAPT. 12 PAGE 22.

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 1.07 (2.50)

A. 1. They are located as far below the normal water line as possible (to provide the greatest static head).
2. With feed flow less than 20% they are kept on minimum speed.
3. At high power operation adequate NPSH is obtained from feedwater subcooling.
4. Low reactor Vessel water level trip, cavitation interlock.
5. Suction valve closed trip, cavitation interlock. (3 @ 0.5 ea)

B. ~~NPSH is the required press and temp conditions at the suction of a pump that will not result in cavitation.~~ (1.0)
NPSH is defined as the difference in pressure between the static pressure at the eye of a pump and saturation pressure.

REFERENCE
Dresden Recirc System Lesson Plan pg 16 & 18

ANSWER 1.08 (1.50)

A. The pump will eventually add a sufficient amount of heat to the fluid to cause cavitation (will accept overheating of the pump). (0.5)

B. Could cause excessively large starting currents OR water hammer if the downstream piping was not filled. (0.5)

C. Causes excessive motor amps to be drawn. (0.5)

REFERENCE
GE THERMO HT & FF pg 7-123, 124
DRESDEN T.H.T.F.F. LESSON PLAN PAGE 8.

ANSWER 1.09 (2.00)

A. The subcooling of condensate below the saturation temperature. (.5)

B. Without CD, the condensate pumps would cavitate. (1.0)

C. Cycle efficiency would be decreased. (0.5)

REFERENCE
GE THERMO HT & FF, CHAP 6
DRESDEN T.H.T.F.F. LESSON PLAN PAGE 8.

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 1.10 (1.50)

A. U-235, U-238 (.25 each) (.5)
B. Pu-239 (.5)
C. U-235, Pu-239 (.25 each) (.5)

REFERENCE
RX PHYSICS REVIEW, pg 32
DRESDEN REACTOR THEORY BOOK 4 CHAPT.12 PAGE 32.

ANSWER 1.11 (2.00)

A. Alpha V increases power
B. Alpha T increases power
C. Alpha D decreases power
D. Alpha V decreases power (4 @ 0.5 ea)

REFERENCE
DRESDEN - GE BWR Transient Analysis

ANSWER 1.12 (2.00)

a. 4.77% (+- .48%)
b. 3.8% (+- .38%)
c. 1.0% (+- .10%)
d. 3.0% (+- .30%) [4 @ 0.5 each] (2.0)

REFERENCE
Dresden Reactor Physics Lesson Plan Book 4, Ch. 12, PP. 26-32, Figures 58-62
GGNS: OP-NP-513, OP-NP-514
EIH: L-RO-604; L-RO-605

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 1.13 (1.00)

70% void fraction in the core (0.5)

There is a larger % change in water volume for the same increase (3.45% vs 1.1%) [0.5]

-OR-

The voids produced at 70% VF have a larger effect on core reactivity since they are in an area of higher neutron flux [0.5]. (0.5)

REFERENCE
Dresden Reactor Physics Review Lesson Plan, Book 4, Ch. 12, P. 33

ANSWER 1.14 (1.00)

e. (1.0)

REFERENCE
GE THERMO HTX & FF, pg 9-102

ANSWER 1.15 (2.00)

a.1. increase
a.2. increase
a.3. remains the same
b.1. increase
b.2. decrease
b.3. increase [6 @ 0.33 ea]

REFERENCE
NMP1 Reactor Theory, Module 1, part 12, 13, & 14

DRESDEN - Lesson Plan Book 4, Ch 12, Rx Physics Review, pg 26-35

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 2.01 (1.50)

a. Rx building equipment drain tank overflow
b. Non-regenerative heat exchanger drains
c. Shutdown heat exchanger drains [3 @ 0.5 each] (1.5)

REFERENCE
Dresden Student Text #1, Book 4, Table 5

ANSWER 2.02 (3.00)

a. 1. Moisture separators
2. Local instrument air receivers
3. Prefilters
4. Main instrument air receiver ← s: Afterfilter [5 @ (0.4) each] (2.0)

b. 1. Service air between the 2A instrument air receiver and prefilters. (0.5)
2. Unit 3: on the main header downstream of main instrument air receiver. (0.5)

REFERENCE
Dresden Student Text #3, PP. 8 and 9, Figure 1

ANSWER 2.03 (.50)

b. (0.5)

REFERENCE
Dresden Student Text #2, Book 3, Page 11

ANSWER 2.04 (2.00)

a. To provide a flow path around the filter and demineralizer during backwashing, precoating and resin replacement. (1.0)
b. Provide a flow path for the additional system flow generated when both pumps and heat exchangers are used. (1.0)

REFERENCE
Dresden Student Text #5, Book 3, P. 14

ANSWER 2.05 (1.50)

a. Crud removal from bottom of reactor
b. Prevent temperature stagnation in bottom head
c. Measurement of bottom head water temperature [3 @ 0.5 each] (1.5)

REFERENCE
Dresden Student Text #5, Book 3, P. 2

ANSWER 2.06 (2.75)

a. 1. Low reactor pressure at 80 psig (0.5)
2. High HPCI area temperature at 200 F (0.5)
3. High steam line flow at 300% (0.5)
b. 1. Isolation valves 2301-4, 5, 35, and 36 close (0.5)
2. The aux oil pump is interlocked against an auto start. (0.25)
3. Decreasing loss of oil pressure starts closing stop and control valves. (0.25)
4. Emergency oil pump starts. (0.25)

REFERENCE
Dresden Student Text #10, Book 3, P. 30

ANSWER 2.07 (3.25)

a. 1. DW pressure >/= +2 psig ~~(0.5)~~ (.28)
2. Rx water level </= 59" ~~(0.5)~~ (.28)
3. 120 second timer timed out ~~(0.5)~~ .28
4. Any core spray or LPCI pump running with >/= 100 psig pressure ~~(0.75)~~ (.42)
b. 1. Off - Auto-blowdown only (0.25)
2. Manual - Always energized (0.25)
3. Automatic - Auto blowdown signal and relief signal (0.5)

REFERENCE
Dresden Student Text #11, Book 3, PP. 3, 5 and 6

5. Rx water level (.14) < -59 "(.14) AND 8. 5 min timer timed out (.14) AND either core spray (.14) or any LPCI pump running (.14) with at least 100 psig discharge pressure. (.14

ANSWER 2.08 (2.75)

a. 1. 1070 psig (Ø.5)
   2. 15 second (Ø.5)

b. Allow for the decay of the pressure spike which occurs because of the MSIV or main stop valve closure to prevent spurious or frequent initiation of the system during anticipated turbine trips. (1.Ø)

c. 1. Clean demineralized water (primary)
   2. Condensate transfer (backup)
   3. Service water "OR" fire protection (backup)
   [3 @ Ø.25 each] (Ø.75)

REFERENCE
Dresden Student Text #12, Book 3, PP. 7 and 10

ANSWER 2.09 (2.ØØ)

a. The risers are provided to permit lowering the recirculation inlet nozzles [Ø.5] to remove them out of the active core region [Ø.5]. (1.Ø)

b. So that they do not receive a significant fast neutron exposure [Ø.5] which could change the mechanical properties of the materials [Ø.5]. (1.Ø)

REFERENCE
Dresden Student Text #1, Book 1, P. 13

ANSWER 2.1Ø (2.ØØ)

a. 1. Motor Pump A MCC 28-1 (Ø.25)
   2. Motor Pump B MCC 29-1 (Ø.25)

b. 480/12Ø AC from MCC 28-1 and 29-1 (Ø.5)

c. To prevent chugging [Ø.25]. As the reactor pressure decreased, [Ø.25] the flow from a centrifical pump would INCREASE [Ø.25] resulting in a rapid injection of boron [Ø.25]. (1.Ø)

REFERENCE
Dresden Student Text #3, Book 3, PP. 5 and 11

ANSWER 2.11 (1.00)

a. 0.5 psid (0.25)
b. Closed (0.25)
c. Rx building to torus and torus to drywell (0.5)

REFERENCE
Dresden Student Text #15, Book 3, PP. 15 and 16

ANSWER 2.12 (2.50)

a. Standby coolant supply system
b. Steam flow restricters
c. CRD velocity limiters
d. CRD housing supports
e. Standby liquid control system
f. Drywell nitrogen inerting [5 @ 0.5 each] (2.5)

REFERENCE
Dresden Student Text #5, Book 1, P. 5

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 3.01 (2.75)

a. 10% (0.25)
b. Primary: to avoid confusing the LPCI loop select logic (0.5)
Secondary: To prevent flow-induced vibration in the jet pumps (0.5)
c. Prevents the high speed pump from increasing and the low speed pump from decreasing. (0.5)
d. If the mismatch exceeds 10% and the discharge valve on the low speed pump is closed. (0.5)
e. A ~~20 second~~ time delay. (0.5)

REFERENCE
Dresden Student Text #2, Book 2, PP. 12-14

ANSWER 3.02 (2.50)

a. The detectors are geometrically arranged so the system is capable of detecting any significant increase in radiation level for any number of lines in operation. (0.75)
b. Gamma sensitive Ion chamber. (0.5)
c. N 16 gamma (0.5)
d. Because the hydrogen addition to Unit 2 causes an increase in the N 16 levels. (0.5)
e. No (0.25)

REFERENCE
Dresden Student Text #1, Book 3, PP. 1 and 3

ANSWER 3.03 (2.50)

1. Supply breaker trip on a running feed pump.
2. A standby RFP is selected.
3. Suction pressure above the trip setpoint of 120 ~~psig~~ PSIG.
4. At least one ventilation fan is operating.
5. Oil pressure is greater than 20 psig
6. Rx water level less than 55" [5 required @ 0.5 each] (2.5)

REFERENCE
Dresden Student Text #4, Book 2, PP. 23 and 24

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 3.04 (3.00)

a.	1.	0 to +60 in	(0.25)
	2.	Temperature compensated by a pressure signal (electrical compensation)	(0.25)
	3.	Level input to feedwater control	(0.25)
b.	1.	-60 to +60 in.	(0.25)
	2.	Heat clamp between the reference and variable leg	(0.25)
	3.	Recirc pump trips and ARI valve opening	(0.25)
c.	1.	-70 to +330 in.	(0.25)
	2.	None	(0.25)
	3.	None	(0.25)
d.	1.	-340 to +60 in.	(0.25)
	2.	None	(0.25)
	3.	LPCI/containment spray interlock	(0.25)

REFERENCE
Dresden Student Text #4, Book 1, PP. 3, 4, and 5

ANSWER 3.05 (1.75)

LPSP Actuate
Total steam flow >/= 20% AND feed flow >/= 10% for at least 60 seconds (0.75)
Deactuate steam flow </= 20% OR feed flow </+ 10% (0.5)

LPAP Actuate
Total steam flow >/= 35% (0.25)
Deactuate total steam flow </= 35% (0.25)

REFERENCE
Dresden Lesson Plan #8, Book 1, P.7

ANSWER 3.06 (2.75)

a. One channel upscale and one channel downscale, or both channels upscale. (1.0)
b. 1. Off-Gas chimney Isolation valve closes. (0.5)
2. Off-Gas drain valve closes. (0.5)
3. Off-Gas pressurized drain tank is isolated from the pressurized drain pump. (0.5)
c. 15 minutes (0.25)

REFERENCE
Dresden Student Text #1, Book 3, Page 8

ANSWER 3.07 (.50)

2000 RPM (0.5)

REFERENCE
Dresden Student Text #10, Book 3, P. 35

ANSWER 3.08 (1.00)

a. Increase (0.5)
b. None (0.5)

REFERENCE
Dresden Student Text #4, Book 1, PP. 15 and 16

ANSWER 3.09 (2.00)

The RFP runout relay energizes a soleniod valve which blocks the supply from the positioner output and places full 100 psig instrument air on top of the valve diaphragm. (2.0)

REFERENCE
Dresden Student Text #6, Book 2, P. 6

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 3.10 (2.00)

a. Senses low air pressure and deenergizes the solenoid operated pilot valve.
b. Isolates and bleeds off the air supply to the air dump valve.
c. Air dump valves exhaust air from the air lock valves.
d. Air lock valves reposition to interrupt any air signal from the positioner and lock the air in the valve operator.
[4 @ 0.5 each] (2.0)

REFERENCE
Dresden Student Text #6, Book 2, P. 2

ANSWER 3.11 (2.00)

a. Auto start of standby EHC pump.
b. Turbine trip on low FAS oil pressure (indirect reactor scram).
c. Direct reactor scram.
d. Lock in master trip relay and all valves closed signal to EHC pressure control logic. [0.4 each + 0.1 each for correct order] (2.0)

REFERENCE
Dresden Student Text #8, Book 2, P. 18

ANSWER 3.12 (2.00)

a. A loss of stator cooling will cause a turbine runback to 25% of rated load in 3 minutes. (1.0)
b. Reset the generator lockout relay. (1.0)

REFERENCE
Dresden Lesson Plan #11, Book 2, PP. 8-10

ANSWER 3.13 (2.00)

1. A loss of control power preventing breaker operation. (1.0)
2. Loss of trip circuit continuity which would prevent the breaker from being tripped from the control room. (1.0)

•ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

REFERENCE
Dresden Lesson Plan #12, Book 2, PP. 11-12

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 4.01 (.50)

1. One minute
2. Seal [2 @ 0.25 each] (0.5)

REFERENCE
Dresden, DOP 202-1, P. 2

ANSWER 4.02 (2.50)

a. Reactor scram
b. Group 1 isolation
c. Chimney isolation valve closure
d. Air ejector suction valve closure
e. Mechanical vacuum pump trip [5 @ 0.5 each] (2.5)

REFERENCE
Dresden DGA 16, P. 1

ANSWER 4.03 (2.00)

a. 1. Hour
   2. Vessel metal
   3. Water level or water temperature
   4. Water temperature or water level [4 @ 0.25 each] (1.0)

b. 1. Increase SDC flow
   2. Start another SDC pump
   3. Start CRD pumps
   4. Flood the main steam lines while draining through the main steam line drains [4 @ 0.25 each] (1.0)

REFERENCE
Dresden DOP 1000-3, P. 3

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 4.04 (2.00)

a. Unit 3 60%
Unit 2 43% [2 @ 0.5 each] (1.0)
b. Inadequate jet pump riser in Unit 2 which causes large jet pump vibrations during single loop operation. (1.0)

REFERENCE
Dresden DOA 202-1, PP. 1 and 4

ANSWER 4.05 (1.50)

The notch override switch shall [0.5], not be used between positions 00 and 24 [0.5] until the first bypass valve is open [0.25], or the unit is on the line [0.25]. (1.5)

REFERENCE
Dresden DGP 1-4, P. 32

ANSWER 4.06 (1.00)

"At-the-controls" means the unit operator is in line of sight of the unit front panels. (1.0)

REFERENCE
Dresden DAP 7-2, P. 4

ANSWER 4.07 (1.00)

a. Rx power > 20% (0.5)
b. 65-100% of rated core flow (0.5)

REFERENCE
Dresden 2 Tech. Spec. 3.3.G

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 4.08 (.50)

Only after the pump suction and discharge valves are open.

REFERENCE
Dresden, DOP 202-1, P. 3

ANSWER 4.09 (1.00)

a. By attempting to withdraw the rod past position 48. (0.5)
b. Rod overtravel alarm. (0.5)

REFERENCE
Dresden, DOP 400-1, P 4
DOP 400-2

ANSWER 4.10 (.75)

1. 100 cps
2. 1 x 10 E+5 cps
3. ~~4~~ Range 3 [3 @ 0.25 ea] (.75)

REFERENCE
Dresden, DOP 700-1, P. 3

ANSWER 4.11 (2.50)

1. Amber light of squib firing continuity circuit not lit.
2. Flow indicating pilot light ~~not~~ lit.
3. Rx water cleanup system isolation.
4. Decreasing level of Standby Liquid Storage Tank.
5. Standby liquid squib valve circuit fail annunciator light lit.

[5 @ 0.5 each] (2.5)

REFERENCE
Dresden, DOP 1100-2, P. 3

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 4.12 (1.25)

a. 1. 95 F
   2. 105 F
   3. 5 minutes [3 @ 0.25 each] (0.75)
b. 110 F (0.25)
c. Scram the reactor (0.25)

REFERENCE
Dresden, Tech. Specs. 3.7.A.1

ANSWER 4.13 (2.00)

a. By removing the amphenol type plug connectors from the drive insert and withdrawal solenoids. (1.0)
b. This is preferred as it continues cooling water flow and minimizes crud accumulation in the drive. (1.0)

REFERENCE
Dresden, Tech. Spec., Bases 3.3.A.2, P. B/34.3-15

ANSWER 4.14 (1.00)

a. greater than 5 millirem/hour (0.5)
b. Greater than 100 millirem/hour (0.5)

REFERENCE
Dresden, Radiation Protection Standards, P. 3

ANSWER 4.15 (1.50)

a. 3.0 rem/qtr
b. 7.5 rem/qtr
c. 18.75 rem/qtr [3 @ 0.5 each] (1.5)

REFERENCE
Dresden, Radiation Protection Standards, P. 24

ANSWERS -- DRESDEN 2&3 -86/06/24-HANEK, J.

ANSWER 4.16 (1.00)

a. TRUE (0.5)
b. FALSE (0.5)

REFERENCE
Dresden, DFP 800-1, P. 4

ANSWER 4.17 (2.50)

1. Slow
2. Fast (clockwise)
3. Incoming
4. Higher
5. Running [5 @ 0.5 each] (2.5)

REFERENCE
Dresden, DGP 1-1, PP. 25 and 26

ANSWER 4.18 (1.50)

a. Voltage adjust
b. EXC field VAR AC control or VARIAC [2 @ 0.75 each] (1.5)

REFERENCE
Dresden, DGP 1-1, P. 26