U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 85001(DRS)

Docket No. 50-341 License No. CPPR-87

Licensee: The Detroit Edison Company
6400 North Dixie Highway
Newport, MI 48166

Facility Name: Fermi Nuclear Power Station

Examination Administered At: Fermi Nucler Power Station

Examination Conducted: February 12, 1985

Examiners: T Lang
T. Lang 5-16-85
Date

J. I. McMillen for
I. Levy, PNL 5/17/85
Date

J. I. McMillen for
G. Sly, PNL 5/17/85
Date

J. I. McMillen
Approved By: J. I. McMillen, Chief
Operator Licensing Section 5/17/85
Date

Examination Summary

Examination administered on February 12, 1985 (Report No. 85001)(DRS))
Examinations were administered to one Senior Reactor Operator, seven Reactor Operators and three Instructor candidates.
Results: Two instructors and all of the Reactor Operators passed the examination.

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REPORT DETAILS

1. Examiners

   T. Lang, NRC
   I. Levy, PNL
   G. Sly, PNL

2. Examination Review Meeting

   R. Bouinet
   S. Heard
   E. Preston
   G. Overbeck

   During the review very few comments were made to the SRO examination. They were so few that they were incorporated directly to the answer key. RO examination comments are detailed in Attachment A.

3. Exit Meeting

   The exit meeting was conducted satisfactorily and the utility was informed of the candidates who clearly passed the oral/operating examination.

ATTACHMENT A

Comment 1.1 Why are U235 and U238 mentioned.

RESPONSE

References to U-235, U-238, and Pu-239 in the answer key were incorporated to more fully evaluate candidate's response. Candidate was not required to mention individual isotopes, but only that Resonance capture was a negative reactivity effect.

Comment 1.5 Answer: May take it out further than this. We would end up back in the source range until cooldown brought Rx critical again.

RESPONSE

Facility comment has no bearing on grading of question. No action taken.

Comment 1.6 Answer: The process computer calculates Quality and Boiling length based on Core Flow, Inlet Subcooling, Thermal Power and Pressure. You may get these as answers also based on "measurement" in question.

RESPONSE

The comment is valid, Quality and Boiling length are not measurable parameters but calculated. The answer key has been modified to read:

1. Core Flow
2. Inlet Subcooling
3. Thermal Power
4. Pressure

Any two (2) of the above will be acceptable for full credit.

Comment 2.1 Answer: Setpoint 120 gal.
Allowable 160 gal.
for scram.
T.S. change.

RESPONSE 2.1

Since 100 inches is comparable to 120 gallons in the scram discharge volume, either answer is acceptable for the scram setpoint.

REFERENCE: Tech. Spec. Table 2.2.1.1 Final Draft.

Comment 2.2 Answer: May see reference to maximum 3" level deviation if all reference leg inside drywell flashes.

RESPONSE 2.2

Comment was accepted, but answer key not modified because facility comment was considered not the most optimum answer and is self explanatory if given by a candidate.

Comment 2.3 Answer 4: May also see reference to Iodine dissolution in water.

RESPONSE 2.3

Comment was considered a secondary effect of the condensation process and was not considered necessary for full credit.

Comment 2.4 Answer: May see single coincidence or 1/18 for whole system.

RESPONSE 2.4

Since question requests the trip logic for <u>EACH</u> Neutron Monitoring System, a response of "single coincidence" is incomplete unless accompanied with 1 of 18 or listed once for each system. Answer key was modified to include single coincidence and 1 of 18 or single coincidence - SRM, IRM, APRM.

Comment 2.6 Answer: Some may specify the power supply.

RESPONSE 2.6

Comment ignored because question requests "power supplies." If candidate provides bus information it will be graded according to supplied reference materials as to correct or incorrect.

Comment 2.9 Answer: CST Level Setpoint

Setpoint	Allowable value
3" Ind.	may see 24" above bottom
27" above bottom	or 0" indicated

RESPONSE 2.9

Values were verified with references provided and answer key was modified to include either answer 10,000 gallons or 3" indicated or 27" above bottom for the CST level setpoint.

REFERENCE: Tech. Spec. Table 3.3.3-2, pg. 3/4 3-27

Comment 3.1 Answer: It means what you say, but you may hear:

Rod not selected and odd picked up or even dropped out.

Timer timed out and even not picked up.

RESPONSE 3.1

Rephrase of answer key was found to be acceptable and answer key was modified to use the "trained" terminology.

Comment 3.2 Answer: Lower
Higher
Same
↓ L-3 trip back to 195"

RESPONSE 3.2

Comment was considered, but should have no effect on responses because candidates were directed to respond with increase, decrease, or remain the same not higher, lower or same. No action taken.

Comment 3.4 Answer: Should say:

73% CV Demand

We normally accept 5% if SRV opens at less than set pressure.

RESPONSE 3.4

Values (i.e., 73% and 5%) were included to provide clarification for the grader and not required for full credit. The answer key had, 78% and 7% respectively and was modified to reflect the correct values even though they were not required.

Comment 3.5 Answer:

1) Downscale not operable unless companion IRM upscale.

2) I interpreted question to mean which output functions generate trips:

Answers could vary from

4 - fixed/ thermal/ INOP / Rod
upsc/ upsc/ /Blocks

24 - (same for each channel)

Answer: LPRM's not part of trip circuit. Input to trip circuit only. <u>Fixed</u> <u>Upscale</u>

Answer: Fixed upscale/Thermal Upscale/INOP

RESPONSE 3.5

a. The question elicits a number of responses depending upon the interpretation of the term "trip circuits." Since this is true, credit will be given for the following responses:

4 - fixed (neutron) upscale
thermal upscale
inop
downscale

Rod block and alarms will not be considered trip circuits but no credit will be removed if given.

b. The answer key was modified to read fixed upscale or neutron upscale.

c. The correct response should be the same as in part a. The downscale trip circuit will input into the RPS system. Rod blocks and alarms do not and credit was taken off if given.

Comment 3.6 Answer: Assume below LPSP.

RSCS group notch control.
One notch other way.

RESPONSE 3.6

If candidate stated that he was below the LPSP an insert response of one notch is correct. Answer key was modified to reflect the response.

Comment 3.8 Answer: If only one heater drain isolates,
No Action
if both, your answer correct.

RESPONSE 3.8

During the examination the candidates were told that only one heater drain had isolated, therefore, no action is the correct response and the answer key has been changed.

Comment 3.9 Answer: 1. On LOP

1) Load Shed
2) DG Start
3) DG BKR Closes when LS complete.
(6 and 7 BKRs open)
4) DG BKR closes (s and volts)
5) Non LOCA loads sequenced on:

DW Cooling fans
DG Aux.
Valve Power

2. Following LOP if LOCA

    1) Load Shed
    2) DG continue to run
    3) Load sequence RHR/CS etc.

3. Following LOCA if LOP

    1) Load Shed
    2) Start ECCS loads

4. No ten minute time delay

RESPONSE 3.9

a. The facility comment is just clarification of the proper response. No action taken.

b. The 10 minute time delay was eliminated from the answer key. This changed the answer key to "yes (0.25), if you have adequate core cooling or indication of system malfunction (0.5)."

Comment 4.5 Answer: Or voiding causes power reduction while injecting Boron.

Level

RESPONSE 4.5

b. Facility comment was considered correct and added to answer key. Both responses were necessary for full credit.

c. No action taken "indicated zero" is throughout procedure and should be known.

Comment 4.7 Question should state during changing operation.

RESPONSE 4.7

Due to the vagueness of the wording of the question, credit was given for both 1) when the nitrogen purge gas remains constant, or 2) when no more fluid is observed exiting the drain valve.

Comment 4.8
+ 2"
- 2"
138°F Drywell
95°F Torus
1.93 psig

RESPONSE 4.8

Comment reflects recent Technical Specification changes and the answer key has been modified.

Additional facility comments received February 26, 1985.

Comment 1.3 Answer: This question postulates a loss of feedwater heating as the reason for the moderator temp reduction of 75°F during a startup.

Areas of confusion:

a. A loss of feedwater heating would lead the operators to believe that we are at power, as such no change in moderator temperature would occur due to pressure control. We would see a change in inlet subcooling which would cause a power increase. This would not be viewed as a heatup or a cooldown rather it would be a power excursion.

b. In another view a 75° reduction in moderator temperature would result in a depressurization and resultant closure of the MSIV's and subsequent scram again a transient but no net heatup or cooldown.

Additionally, the second part of the question asks "which limit is more restrictive." While we all know that cooldown stresses are more limiting, in actuality our heatup limit is more restrictive than it needs to be since it is equal to the cooldown limit. Either answer with an explanation would of course be correct.

RESPONSE 1.3

a. The question elicits a response of heatup or cooldown not pressure or power as the facility comment suggests. It was also clarified during the exam that the core inlet enthalpy changed in an amount equal to 75°F. Due to these facts no change was made to part a. of the key.

b. No change was made to answer key because during the exam it was stated that we were looking for the most "physically/vessel restrictive" not administratively restrictive.

Comment 1.4 Regarding the question dealing with removal of a source from a level of 6000 cps:

The correct answer per your key was a "non-linear progression."
Area of Concern:

a. The change in neutron level would describe a linear plot on the SRM's since they are log scales.

b. The neutron population will stabilize at a very low level (probably below our indication) but it will stabilize due to intrinsic sources.

RESPONSE 1.4

The question requested the <u>MOST</u> correct answer which is "2" non-linear progression. It did not solicit what the operator saw on his script recorder or meter nor did it solicit an evaluation of final countrate with "intrinsic" sources. Sources and subcritical multiplication are very basic fundamental area of reactor theory and the candidate should be cognizant in this area. No action taken.

Comment 1.12 Regarding the question dealing with Thermal Neutrons and their ability to produce embrittlement:

For stainless steels exposed to a thermal reactor fluence of 10^{21} N/cm^2-sec, the tensile properties show some increase in ultimate strength, an almost three fold gain in the yield strength and a drop of about 1/3 ductility. Thought to be due to trace Boron impurities.

Ref: Basic Nuc. Rx Eng.
Foster & Wright Pg. 355

Therefore while thermal neutrons do not cause direct damage, there is some indirect damage.

Also defect production as a result of thermal neutron irradiation is largely due to the recoil of nuclei that have absorbed a thermal neutron and emitted one or more γ's.

Additionally while the damage due to fast neutrons is on the order of 90 times as great as thermal, the answer is not always false.

RESPONSE 1.12

Since the question requested an explanation of why the statement was true or false, credit would have to be given for a true response if properly justified. The answer key was not modified because, according to your own admission, thermal neutrons "....do not cause direct damage...." and "damage due to fast neutrons is on the order of 90 times as great as thermal...."

Comment 4.9 Regarding the question dealing with what four (4) things are logged in the NSO's log when the reactor is declared critical, you may find that the examinees listed only four (4) items, i.e.,

1. Rod Number
2. Rod Notch
3. Rod Sequence This was specified as one item
4. Rod Group in your key.
5. Period
6. Temperature
7. Time

Four of the above, they may not have lumped all of the Rod Parameters into one group.

RESPONSE 4.9

The question states which items <u>MUST</u> be logged, these are:

1. Temperature
2. Time
3. Period
4. Critical Rod Position

The other items listed rod number, rod notch, rod sequence, and rod group are considered to be a subset of rod position (i.e., you could in the same token separate time into hour, minute, second). But due to the non-explicit wording of the question partial credit will be given if the candidate broke the critical rod into its subcomponents.

MASTER COPY QUESTIONS

U. S. NUCLEAR REGULATORY COMMISSION

REACTOR OPERATOR LICENSE EXAMINATION

Facility: FERMI-2

Reactor Type: BWR

Date Administered: 2-12-85

Examiner: GA SLY

Candidate: ____________

INSTRUCTIONS TO CANDIDATE:

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

Category Value	% of Total	Candidate's Score	% of Cat. Value	Category
25	25			1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
25	25			2. Plant Design Including Safety and Emergency Systems
25	25			3. Instruments and Controls
25	25			4. Procedures: Normal, Abnormal, Emergency, and Radiological Control
100				TOTALS

Final Grade ________ %

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

____
Candidate's Signature

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3.5

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100				TOTALS

Final Grade ________ %

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____
Candidate's Signature

1.0 PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

1.1 238U is a major component of the fuel in a BWR:

foc.

a. What two neutron reactions occur with the 238U during core life? (0.5)

* b. Explain whether these reactions have either a positive or negative reactivity effect. (1.0)

c. Which of the reactions in Part (a) occur as a result of the Doppler effect? (0.5)

1.2 Sketch on one figure three curves that represent the time dependence of Xe poisoning. All curves are to represent the effects of a rapid power change. The equilibrium value of Xe is 100% at full power.

a. Curve 1: The curve that results for a power reduction from 100% to zero at time equal zero. Show the curve for 30 to 40 hours. (1.0)

b. Curve 2: The trace that results from the reactor being returned to full power 5 hours after shutdown. (1.0)

c. Curve 3: The curve produced, if instead of at 5 hours, the reactor was not restarted until 15 hours after shutdown. (1.0)

foc. * 1.3 During a reactor startup, the loss of a feedwater heater string causes the core mtl ~~coolant~~ temperature to change 75°F in a ten (10) minute period. (Assume the coolant temperature was stable from that point on).

a. State whether this was a heatup or cooldown concern and if the heatup or cooldown limit was exceeded. (1.0)

b. Which limit is more physically restrictive heatup or cooldown? Why? (1.0)

- Section 1 Continued Next Page -

1.4 The reactor is stable with K effective equal to 0.95 and a stable neutron countrate of 6000 neutrons per generation.

a. If all sources were instantaneously removed would the neutron level (choose the most correct answer): (1.0)

1. decrease in a linear progression
2. decrease in a non-linear progression
3. stay the same due to continuous subcritical multiplication of existing neutrons
4. decrease to constant neutron level equal to the maximum neutron level minus the source strength.

b. If the source strength were doubled the critical rod position (Keff=1) would increase, decrease, not change? Explain. (1.0)

1.5 a. During a startup, a 90 second period is established. Ideally how much time would be required for an IRM signal to go from 50 on Range 2 to 20 of Range 5? (1.0)

fac. *

b. If no action is taken by the operator (other than changing ranges), what would happen to the power level? Include in your discussion the reasons for any changes in the power level or the reactor period, and the IRM ranges on which these changes would take place. (2.0)

fac. *

1.6 Since MCPR is not a directly measurable parameter, what are two (2) measurement core parameters needed by the process computer to calculate MCPR? (1.0)

1.7 For each of the following conditions, state whether it will cause an increase, decrease or have no effect on critical power. Assume all other parameters are constant. (2.0)

a. decrease in reactor power
b. increase in inlet subcooling
c. increase in core flow
d. location of axial power peak moves up in the core.

1.8 a. Arrange the following heat transfer flow regimes in order of increasing heat flux. (1.25)

1. Mist Flow.
2. Single Phase.
3. Bubbly Flow.
4. Annular Flow.
5. Slug Flow.

b. Between which two regimes does DNB occur? (0.5)

1.9 You have just completed a power maneuver from 70% to 90% reactor power by increasing recirculation flow. State whether the following would increase, decrease, stay the same. Why?

a. Pressure drop in the main steam lines. (1.0)

b. Average void fraction. (1.0)

1.10 a. The steam jet air ejectors and the recirculation system jet pumps operate on the same principle. Briefly explain their operation. (1.25)

b. If the main condenser and associated systems were absolutely air tight, would there be any need for the SJAE's during (high) power operation? Briefly explain. (1.25)

1.11 Choose the most correct answer for control rod density if the reactor reaches criticality at a point where 63 control rods have been withdrawn to notch position 48 and 4 control rods have been withdrawn to notch position 24. (1.0)

a. 65%
b. 55%
c. 45%
d. 35%

1.12 Explain briefly why the statement is True or False.
High levels of thermal neutron irradiation of the reactor vessel causes changes in the mechanical properties of the steel (1.0)

1.13 Explain whether the overall plant efficiency (MWe/MWt) will increase, decrease, or not change due to an isolation at 100% power of the RWCU system. (1.0)

- Section 1 Continued Next Page -

1.14 Assume that the reactor is being started up from cold shutdown and a rod drop accident occurs. Of doppler, void, and moderator coefficients, which will act first, second, and third to limit the rapid power rise? (0.75)

- End of Section 1 -

2.0 PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS

2.1 With regard to the Control Rod Drive (CRD) System:

a. What design feature allows a reactor scram if the reactor pressure exceeds the accumulator pressure or charging water pressure? (0.5)

b. During normal operations the "Accumulator Trouble" alarm illuminates. List the two (2) physical parameters which can cause this alarm. (1.0)

fac *
c. Three (3) distinct trips are initiated based on the level in the scram instrument volume. List the trips, setpoints and the actions which occur. (1.5)

2.2 State whether each incident would increase, decrease, or not change indicated level. Provide adequate support for your response.

a. Incident 1: Leak in reference leg. (1.0)

b. Incident 2: Flashing of the condensing pot. (1.0)

fac. *
c. Incident 3: Temperature increase inside drywell. (1.0)

2.3 Concerning the Offgas System:

a. State the function(s) of the following offgas components: (2.0)

1. Ring water buffer tank
2. Hold-up pipe
3. Sandfilter
4. Condenser (not main condenser)

b. Arrange the above components in order of flow from the main condenser to Reactor bldg. vent. (1.0)

- Section 2 Continued Next Page -

2.4 Concerning the Neutron Monitoring System:

a. What is the range (of output indicator) for the SRM system? (0.5)

b. If an SRM detector loses detector voltage will the sensitivity increase, decrease, or stay the same? (0.5)

c. What minimum number of LPRM inputs are required to an APRM channel to keep it from being declared inop? (0.5)

fac. *

d. What is the RPS trip logic for each Neutron Monitoring System (SRM, IRM, and APRM) with the shorting links removed and the mode switch in Refuel? (1.5)

2.5 How would the RWCU system respond to:

a. high non-regenerative heat exchanger discharge temperature. (1.0)

b. high differential flow (1.0)

Include system actions and components in your response.

2.6 Concerning the Reactor Protection System (RPS):

a. List the normal and alternate power supplies to the Reactor Protection System distribution cabinet. (Include any major differences.) (1.0)

b. The backup scram valves are energize or de-energized to operate in the scram mode. (0.5)

c. Explain how your answer to part "b" would accomplish the scram. (1.0)

2.7 Explain how decay heat is removed from the core following a reactor scram beause of a complete loss of the grid and the diesel generators have failed to start. (1.0)

- Section 2 Continued Next Page -

2.8 If the SLC system keylock is turned to the "START Sys B" position:

a. How many squib valves fire? (0.5)

b. List six (6) control room indications that indicate the SLC system is initiated. (2.0)

2.9 Concerning the HPCI system:

a. What is the purpose(s) for the drain pots in the steam supply to turbine line and the turbine exhaust line? (0.5)

b. Upon low CST Level or high Suppression Pool level the HPCI pump suction auto shifts from the CST to the Suppression Pool.

1. What is the CST level and Suppression Pool level that this switch occurs? (1.0)

2. What is the valving sequence for switching the valve line up between the CST and Suppression Pool? (0.5)

2.10 List the three (3) Rod Block Monitor System bypasses and describe the purpose of each. (1.5)

2.11 Concerning the Emergency Equipment Cooling Water System (EECW):

a. Choose the gas that is used to pressurize the Emergency Equipment Cooling Water System makeup tank. (1.0)

1. air
2. nitrogen
3. argon
4. hydrogen.

b. Why is the tank pressurized? (0.5)

- End of Section 2 -

3.0 INSTRUMENTS AND CONTROL

3.1 Concerning the Reactor Manual Control System (RMCS);

loc.

* a. What causes a rod drift light to annunciate? (1.0)

b. Can an overtravel alarm be received if the control rod is connected to its drive unit (yes or no)? (0.5)

3.2 While operating at 80% power and in 3-element control (Level A Controlling), would the final vessel level increase, decrease, or remain the same in response to the following events:

loc.

* a. failure of an SRV full open. (0.5)

* b. failure of feed flow transmitter (downscale). (0.5)

* c. failure of a BPV full open. (0.5)

* d. level A indicator fails full scale. (0.5)

3.3 As condenser vacuum decreases from a normal operating vacuum to atmospheric pressure, what interlocks, trips, or alarms are expected and what are the setpoints for each? [Five (5) of the seven (7) required for full credit]. (2.0)

loc.

* 3.4 What would be the response of the Governor Pressure Control System, if a SRV were to fail open from 80% power? Include in your answer initiating events, responses, and final stable conditions. (1.5)

3.5 Answer the following questions about the Power Range Monitoring System.

loc.

* down [illegible]

a. How many trip circuits are there? (0.5)

* upscale

b. Which trip circuit is calibrated to ensure the maximum LHGR is not exceeded? (0.5)

* Inop

c. Which trips are input to RPS? (1.0)

d. How many APRMs for each RPS channel may be bypassed at one

- Section 3 Continued Next Page -

time without tripping the RPS channel? (0.5)

3.6 When a select error occurs on the RWM:

fac. * a. Can the operator still move the Rod? (RWM is NOT bypassed and NO rod blocks existed prior to selecting the Rod.) Answer YES or NO. (0.5)

fac. * b. If so, how far, and why? If not, why not? EXPLAIN YOUR ANSWER FULLY. Consider both an attempted insert and withdraw action. (2.5)

3.7 Answer if the following questions concerning ADS logic, seal ins, and resets are True or False:

a. The ADS drywell signal will always "seal in" the ADS logic any time the high drywell limit is exceeded. (0.5)

b. If following an ADS actuation the control room operator presses both ADS timer resets the ADS valves will close and the timer will reset. (0.5)

c. It only takes one ADS Division (Div. I or Div. II) to open the ADS valves. (0.5)

d. If following an ADS actuation the control room operator manually stops all core spray and LPCI pumps the ADS valve will close. (0.5)

- Section 3 Continued Next Page -

3.8 The recirculation flow control system (RFCS) logic was designed with the following flow limits:

1. Limiter #1 limits speed to 30%
2. Limiter #2 limits speed to 45%
3. Limiter #3 limits speed to 80%.

For each of the following conditions state which limiter (if any) would control the RFCS circuitry. (Respond with limiter number, speed, or no speed limiter actuation.)

a. Condition #1: 100% power operation, feedwater control system in auto, and recirculation pump discharge valve closes to the 90% position. (0.5)

fac.
X

b. Condition #2: 100% power operation and the North #5 heater drain isolates on high level. (0.5)

c. Condition #3: 70% power operation, feedwater control system in auto and "A" reactor feed pump trips. (0.5)

d. Condition #4: 70% power operation, feedwater control system in auto and the "A" motor generator scoop tube locks up. (0.5)

3.9 Concerning the load shedding and sequencing system:

a. What are three (3) types of events that the sequencer will recognize and what is the difference in the sequencers response? (2.25)

fac.
X

b. Following a load being resequenced to the proper bus can the operator override this action if the system is not needed? Explain. (0.75)

3.10 Explain how the LPCI Loop Select Logic functions once an initiation signal is received. (Include in your explanation the effects if the Recirculaton Pumps are running and/or shutdown. Limit answer to selection of a loop only.) (2.5)

fac.
X

3.11 When is it allowable to fully withdraw the SRM detectors without causing a rod block? (1.0)

- Section 3 Continued Next Page -

3.12 Concerning the Residual Heat Removal System:

a. Which RHR pump(s) can be controlled from the Remote Shutdown Panel? (0.5)

b. State the function of the Pressure Switches located in the Discharge line on each RHR pump. (0.5)

c. State the interlock associated with the minimum flow valves (F007A(B)). (1.0)

- End of Section 3 -

4.0 PROCEDURES: NORMAL, ABNORMAL, EMERGENCY, AND RADIOLOGICAL CONTROL

4.1 List eight (8) immediate operator actions following a reactor scram. (Do not include verification or multiple action for same immediate action). (2.0)

4.2 During normal operation the recirculation pump speed mismatch is administratively limited to:

1. 5% of recirculation pump speed at greater than or equal to 70% of rated core flow.
2. 10% of recirculation pump speed at less than 70% rated core flow.

Give three (3) reasons for the mismatch limitations. (3.0)

4.3 Following a Failed Safety Relief Valve (AOP-20.000.25):

a. When must you manually scram the reactor? (1.0)

b. According to the procedure how would this be accomplished? (1.0)

4.4 What three (3) things are you suppose to do prior to entry into an area on a RWP? (1.5)

4.5 According to the Reactivity Control Procedure (EOP-29.000.08), the reactor operator is authorized to start the Standby Liquid Control System:

a. Under what condition(s) is this acceptable? (1.5)

fa. *

b. Following the initiation of the SLC system all water injection is stopped from entering the core. What is the reason for this procedural step? (0.5)

c. Under what condition(s), (other than directed to by S.S.), would you manually override the SLC system once initiated? (0.5)

- Section 4 Continued Next Page -

4.6 Fill in Table 4.6 with the appropriate response: (2.5)

CONDITION	MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE
1. Power Operation	1	6
2. Startup	2	7
3. Hot Shutdown	3	8
4. Cold Shutdown	4	9
5. Refueling	5	10

4.7 With regard to the Control Rod Drive System:

foc. *

a. When the operator <u>discharges</u> the water side of the accumulator, <u>how</u> does he know the accumulator is <u>fully</u> drained? (1.0)

b. Upon recharging the gas side of the accumulator <u>why</u> must the operator wait 30 minutes before certifying the gas pressure? (1.0)

foc. *

4.8 <u>List</u> the entry conditions for the Primary Containment Control emergency procedure (EP-29.000.03). (Setpoints required.) (2.5)

foc. *

4.9 <u>What</u> four (4) items <u>must</u> be logged in the NSO log book when the reactor is declared critical? (2.0)

4.10 A caution in the Residual Heat Removal System (SOP-23.205) states "Do not secure or place an ECCS in Manual Mode unless verified ...":

a. <u>How</u> many independent sources are needed for verification? (0.5)

b. <u>What</u> are the reason(s) for stopping an ECCS system? (1.0)

c. <u>What</u> is the reason(s) behind the caution? (0.5)

- Section 4 Continued Next Page -

4.11 In reference to GOP 22.000.03 "Startup from Cold Shutdown to Rated Power," match the following startup activities with the pressures at which they should be performed, (ONLY ONE CORRECT ANSWER FOR EACH PRESSURE.) (2.5)

a. Place HPCI in "standby"
b. Start a reactor feed pump
c. Place RCIC in "standby"
d. Place turbine sealing steam in service
e. Start SJAE's

1. 25 #
2. 75 #
3. 100#
4. 330#
5. 350#

4.12 According to 22.000.03, (Startup from Cold Shutdown to Rated Power), why is use of the "Emergency In" mode of inserting control rods limited to NECESSARY RAPID POWER REDUCTIONS? (0.5)

- End of Section 4 -

- END OF EXAM -

FIGURE 1.2

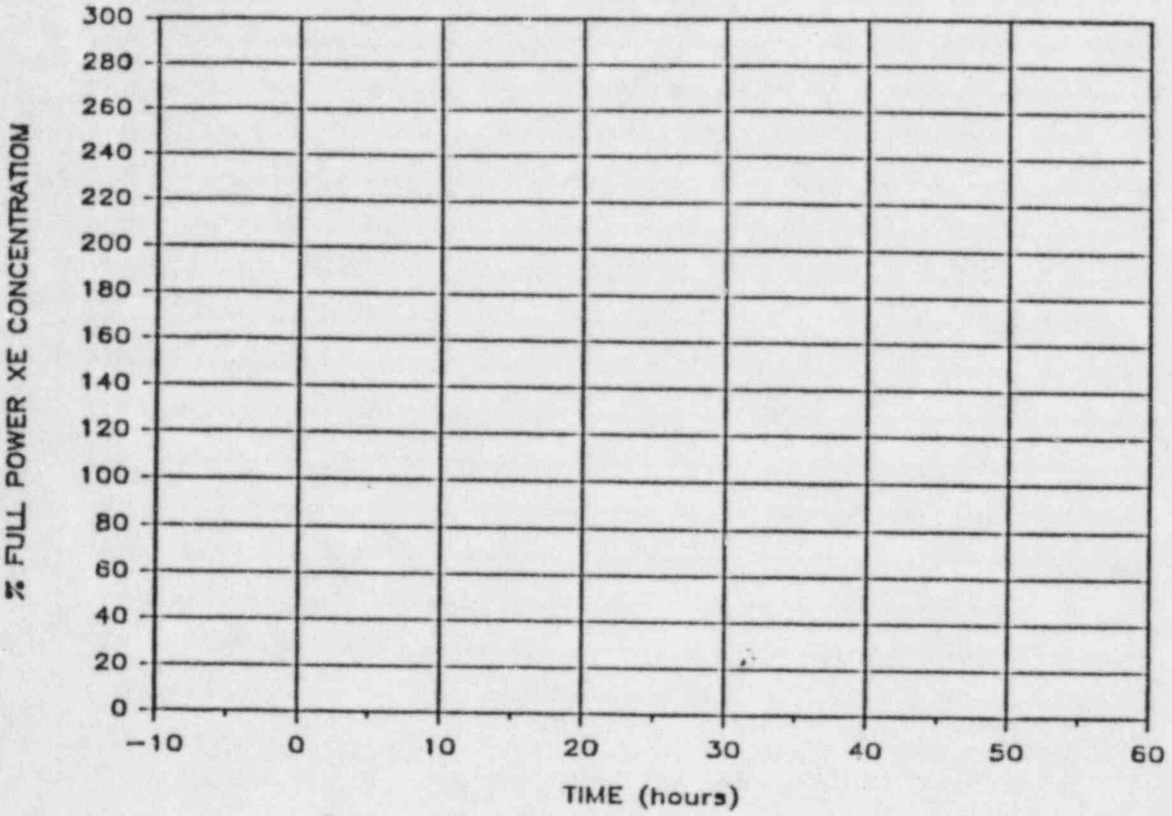

TABLE 4.6

CONDITION	MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE
1. POWER OPERATION		
2. STARTUP		
3. HOT SHUTDOWN		
4. COLD SHUTDOWN		
5. REFUELING		

EQUATION SHEET

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

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

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

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

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

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

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

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

Water Parameters

1 gallon = 8.345 lbs
1 gallon = 3.78 liters

1 ft^3 = 7.48 gallons

Density = 62.4 lbm/ft^3

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

Miscellaneous Conversions

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

1 hp = 2.54×10^3 Btu/hr

1 Mw = 3.41×10^6 Btu/hr

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

MASTER COPY ANSWERS

U. S. NUCLEAR REGULATORY COMMISSION

REACTOR OPERATOR LICENSE EXAMINATION

Facility: FERMI-2

Reactor Type: BWR

Date Administered: 2-12-85

Examiner: GA SLY

Candidate: ANSWER KEY

INSTRUCTIONS TO CANDIDATE:

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

Category Value	% of Total	Candidate's Score	% of Cat. Value	Category
25	25			1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
25	25			2. Plant Design Including Safety and Emergency Systems
25	25			3. Instruments and Controls
25	25			4. Procedures: Normal, Abnormal, Emergency, and Radiological Control
100				TOTALS

Final Grade ________ %

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

Candidate's Signature

U. S. NUCLEAR REGULATORY COMMISSION

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100				TOTALS

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Candidate's Signature

1.0 PRINCIPLES OF NUCLEAR POWER PLANT OPERATION, THERMODYNAMICS, HEAT TRANSFER AND FLUID FLOW

1.1 ANSWER

a. Fast fission (0.25)
Resonance capture (239 Pu) (0.25)

fac. *

b. Fast fission has a positive reactivity effect (0.5)

Resonance capture: (overall negative due to less neutrons)
^{235}U has a negative reactivity effect
^{238}U has a negative reactivity effect
^{239}Pu positive if fissions, negative if produces ^{240}Pu (0.5)

c. Resonance capture (0.5)

REFERENCE: NT/R248 (Reactor Theory) Chapter 3, pg. 9, 10

1.2 ANSWER

(See Graph) Figure 1.2 (3.0)

Grading criteria for each curve.

0.5 curve shape (times, direction, etc.)
0.25 relative maximum
0.25 relative minimum

REFERENCE: NT/R248 (Rx Theory) Chapter 10, pg. 1-10

1.3 ANSWER

fac. *

a. cooldown (0.25), limit not exceeded (0.75) (100°F in one hour.) (1.0)

fac. *

b. Cooldown, (0.~~25~~ 0.5) thermal stress from cooldown results in additive tensile stress at inner vessel walls (0.5). (1.0)

REFERENCE: NT/R248 (Rx Theory) - Chapter 9 pg. 11, 21, 17, 29
Fermi Thermo - Chapter 5 pg. 8

1.4 ANSWER

a. 2 (1.0)

b. not change (0.5), K eff is independent of source strength. (1.0)

REFERENCE: NT/R251 (Rx. Theory) Chapter 11, Chapter 12 pg. 5-8

- Section 1 Continued Next Page -

1.5 ANSWER (0.5 eq., 0.4 numbers, 0.1 math)

a. $P_f = Po\ e^{t/\tau}$

$2000/50 = et/\tau$

t = <u>322 sec</u> 322 (1.0)

for.

b. 1. Assuming the reactor is initially supercritical, the doppler coefficient adds negative reactivity before reaching the heating range, producing a longer period and slower increase in the power rise.(0.5)

2. At the point of adding heat (fuel heat transfer is equal to the ambient losses) the moderator starts to heatup, adding more negative reactivity. Period gets longer and power rise declines even more.(0.5)

3. When the reactor becomes critical (neg. reactivity coefficients equal pos. reactivity from fissions), the IRM pen recorders should indicate a constant power, and the period meter indicates infinity.(0.5)

4. Power will start to decrease because of the increased effectiveness of the moderator coefficient, causing power to stablize at a lower power level than in 3. above.(0.5)

NOTE: (Bulk of answer for grader and clarification) (2.0)

REFERENCE: NT/R251 (Rx Theory) Chapter 11 pg. 9
NT/R237 (Rx Theory) Chapter 13 pg. 1-3

1.6 ANSWER

for

Quality and boiling length. (1.0)

REFERENCE: Fermi Thermo Chapter 9 pg. 5

1.7 ANSWER

a. increase (0.5)
b. increase (0.5)
c. increase (0.5)
d. decrease (0.5)

REFERENCE: Fermi Thermo Chapter 7 pg. 9-11
Chapter 8 pg. 6, 7

1.8 ANSWER

a. 2, 3, 5, 4, 1 (0.25 for each order) (1.25)

b. Annular, mist (0.5)

REFERENCE: Fermi Thermo Chapter 7 pg. 1-5

1.9 ANSWER (0.5 equation, 0.4 numbers, 0.1 math)

a. increase(0.25), greater head losses in piping(0.75) (1.0)

b. decrease(0.25), necessary to compensate negative reactivity from doppler(0.75) (1.0)

REFERENCE: Fermi Exam Bank Questions 1.08 and 1.43

1.10 ANSWER

A jet pump converts velocity heat into a pressure head (0.25). Due to the convergent section of the driving flow nozzle, the driving flow is accelerated at a high velocity, this in turn creates a low pressure in the throat area (0.5). Due to this pressure differential, the driven flow is accelerated and entrained with the driving flow steam. In the diffuser section, a further reduction in velocity is achieved and the resultant discharge pressure is developed (0.5). (1.25)

b Yes (0.25). Even if the main condenser and associated systems were air tight, gasses would collect in the main condenser in the form of Hydrogen and Oxygen (from the radiolytic decomposition of water), (0.5) and fission product gases (which escape from the cladding boundary through "use related" cracks), (0.5) (1.25)

REFERENCE: Fermi Exam Bank Q. 1.56
Fermi Exam Bank Q. 1.14

- Section 1 Continued Next Page -

1.11 ANSWER

a. 65% (1.0)

REFERENCE: Fermi Exam Bank Question 1.38 (rewrite)

1.12 ANSWER

False(0.25), fast only(0.75) (1.0)

REFERENCE: General Rx Theory

1.13 ANSWER

Increase(0.25), because more Rx heat available for turbine since less required for RWCU.(0.75) (1.0)

REFERENCE: Fermi Thermo Text Chapter 4 pg. 22

1.14 ANSWER (0.25 pts for each response)

First-----doppler
Second----moderator
Third-----void (0.75)

REFERENCE: Fermi Exam Bank Question 5.03 (rewrite)

- End of Section One -

EQUATION SHEET

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

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

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

P = Pressure

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

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

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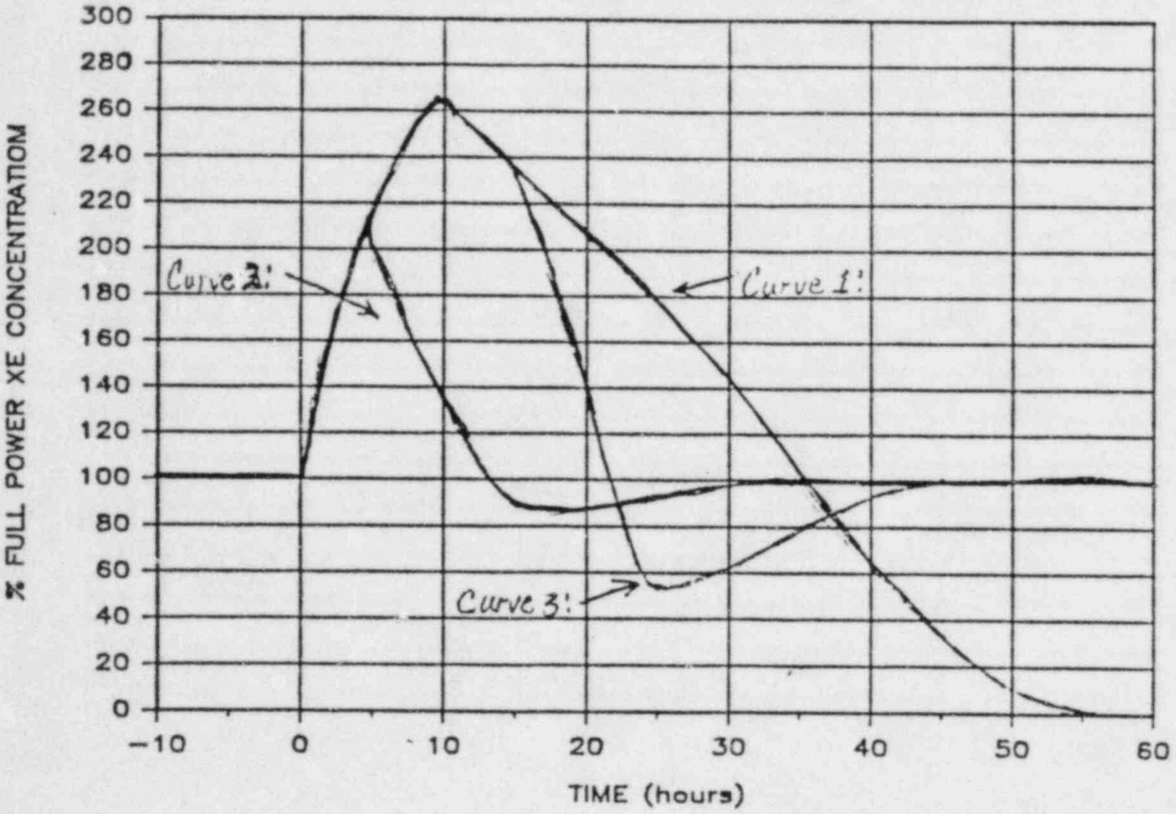
FIGURE 1.2


300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
% FULL POWER XE CONCENTRATION
−10
0
10
20
30
40
50
60
TIME (hours)
Curve 2:
Curve 1:
Curve 3:

2.0 PLANT DESIGN INCLUDING SAFETY AND EMERGENCY SYSTEMS

2.1 ANSWER

a. The ball check valve. (0.5)

b. Low nitrogen pressure (0.5)
liquid leakage (0.5)

* fac.

c. 3 gallons, causes an alarm in control room (0.5)
5 ~~23~~ gallons, causes rod withdrawal block (0.5)
100 inches, causes scram (0.5)

REFERENCE: C11 (CRDM) pg. 15, Rev. 3
PIS #C-11-50 (CRD) pg. 10, 12

2.2 ANSWER (0.25 for change, 0.75 for reason)

a. Increase, due to reduced pressure on reference side of dP cell. (1.0)

b. Increase, due to reduced density in reference leg. (1.0)

* fac.

c. No change, all piping in drywell is horizontal, reference leg is outside drywell. (1.0)

REFERENCE: PIS #B21 (RPV Instrumentation) Figure 2, pg. 4, 16

2.3 ANSWER (0.5 pts for each response)

a. 1. Separate the two-phase air-water mixture discharge from the water ring vacuum pumps. (0.5)

2. Allow short and long-lived isotopes to decay to acceptable levels. (0.5)

* fac.

3. To remove the nongaseous decay daughters and to attentuate a transient pressure wave, thus providing protection for the vessels downstream. (0.5)

4. Reduce the mositure content of the off-gas. (0.5)

b. 4,2,3,1 (1.0)

REFERENCE: N62, (Off-gas System) Pg. 14, 5, 12, 11; Rev. 3

- Section Two Continued Next Page -

2.4 ANSWER

a. 10^{-1} and 10^6 cps (0.5)
b. decrease (0.5)
c. 14 LPRM and at least 2 from each level (0.5)
d. One of four, one of eight, one of six (1.5)

REFERENCE: PIS #C51 (SRM) pg. 23, 7
PIS #C51-12, 13 (PRM) pg. 4, 19
PIS #C51-11 (IRM) pg. 13

2.5 ANSWER (0.5 for each action and 0.5 for cause)

a. Outboard isolation valve (F004) closes(0.5), tripping the RWCU pump(0.5) (1.0)

b. Outboard (F004) and inboard (F001) isolation valve close, with either tripping the RWCU pump. (1.0)

REFERENCE: G-33 (RWCU) pg. 17, 16

2.6 ANSWER

*toc.

a. 1. 480 volts AC power (M/G set) normal. (0.5)
2. 480 volt AC via 480 VAC to 120 VAC transformer. (0.5)

b. energized (0.5)

c. When either backup scram value is energized the air is vented from the lines. This opens the scram valves and closes the scram discharge volume vent and drain values. (1.0)

REFERENCE: PIS-C71 (RPS) pg. 4, 5, 3

2.7 ANSWER

By using HPCI (0.25) or RCIC (0.25) systems and the SRVs in manual (0.5). (1.0)

REFERENCE: Fermi Exam Bank Question 2.09

- Section Two Continued Next Page -

2.8 ANSWER

a. Two (0.5)

b.
1. Continuity lamps extinguish
2. Standby liquid control injection valve ignition continuity loss alarm is annunciated.
3. Pump discharge pressure equal to Rx pressure + 40 psi.
4. Pump run light ON
5. Storage tank level decreasing
6. Rx power level decreasing
7. Testable check valve indicating OPEN
8. RWCU isolated

(Any six @ 0.33 pt. each) (2.0)

REFERENCE: C41 (Standby Liquid Control) pg. 11, 12, Rev. 3

2.9 ANSWER

a. Prevent water hammer by removing condensate. (0.5)

*foc

b. 1. CST - less than 10,000 gallons. (0.5)
Suppression pool - greater than 5" above normal (0.5)

2. Suppression pool inboard isolation valve (F042) opens, Suppression pool outboard isolation valve (F041) opens, and CST isolation valve (F004) closes following F042 & F041 full open. (e.g., Suppression pool valves open proir to closure of CST valve) (0.5)

REFERENCE: PIS E41 (HPCI) pg. 8, 14, 19, Rev. 3

2.10 ANSWER

1. Joystick, bypasses one channel if INOP or for maintenance. (0.5)

2. <30% power, RBM not required because RWM and RSCS "enforce" flux distributions. (0.5)

3. Selected edge rod, can never produce a condition that approaches a thermal limit. (0.5)

REFERENCE: Fermi Exam Bank, Question 2.40
CC51-14 (RBM) pg. 12, Rev. 3

- Section Two Continued Next Page -

2.11 ANSWER

a. 2 (1.0)

b. Assures NPSH. (0.5)

REFERENCE: PIS-P44 (EECW) pg. 14.

- End of Section Two -

3.0 INSTRUMENTS AND CONTROLS

* fac.

3.1 ANSWER

a. The drift alarm will activate when the rod passes an odd numbered read switch (0.5), or dual indication of two different locations (0.5) (1.0)
b. No (0.5)

REFERENCE: C11A-00 (RMCS) pg. 7, 4

* fac.

3.2 ANSWER

a. decrease (upstream flow element) (0.5)
b. increase (0.5)
c. remain the same (downsteam flow element) (0.5)
d. decrease (0.5)

REFERENCE: PIS N21 (Reactor Vessel Level Control System)
pg. 12, 13, Figure 1.

3.3 ANSWER

1. Low Vacuum Alarm	26.3" Hg. decreasing	[illegible]
2. Low Vacuum Turbine Trip	25.5" Hg. decreasing	[illegible]
3. Low Vacuum Bypass Valve Trip	16" Hg. decreasing	6.7
4. Low Vacuum Group 1 Isol	14" Hg. decreasing	71
5. RFP Seal Water Return Pump Auto Start	7 psia	
6. RFP Seal Water Return Pump Auto Stop	6 psia	
7. RFPT High Exhaust Pressure Trip	0 psig	

(5 @ 0.4 ea) [illegible] (2.0)

REFERENCE: INEL Exam Bank Question 5445
PIS #N61 (Main condenser & aux.) pg. 5, 6
N21-1 (feedwater) pg. 10,11,17
Procedure 20.125.01 pg. 2, rev. 3
210/R181/5.15

* fac.

3.4 ANSWER

a. 1. SRV failure 7% flow reactor pressure falls (0.5)
   2. CV start to respond to pressure decrease (voids) (0.5)
   3. CV close to 78% demand and presure returns to normal (0.5)

REFERENCE: PIS #N30-12A (Gov. Pressure Control) Figure 1

- Section Three Contiunued Next Page -

3.5 ANSWER

5

loc. * a. 4 (alarm, thermal, neutron, downscale, INOP) (0.5)

* b. Neutron (LPRM) (0.5)

* c. APRM thermal power, APRM neutron power, APRM downscale, INOP (1.0)

d. 1 (joystick) (0.5)

REFERENCE: C51-13 (PRM) pg. 13, 19, 23, 15

3.6 ANSWER

a. Yes (0.5)

* loc. b. It can be moved one notch out (0.5), before a withdraw block will block further movement.(0.5) If the rod was inserted it will move as far as the operator wants (0.5), as long as it is not the third insert error.(0.5) If it were the third inser error, it would only go one notch.(0.5) (2.5)

REFERENCE: INEL Exam Bank Parent Question 5443,
C11-08 (RWM) pg. 20, 21

3.7 ANSWER

a. true (K38 seal in) (0.5)

b. true (K9B TDC opens/resets) (0.5)

c. true (KGA,B & K7A,B close) (0.5)

d. true (KGA,B & K7A,B - Trip) (0.5)

REFERENCE: (B21-04) (ADS) pg. 6, 7, Figure 2.
Logic diagram (03-15-42-01-A2)

3.8 ANSWER

a. Limiter #1 (30%) (0.5)

* loc. b. ~~Limiter #3 (80%)~~ [illegible] (0.5)

c. No limiter (0.5)

d. No limiter (0.5)

REFERENCE: B-31 (FWCS) pg. 10, 13, Rev. 3

- Section Three Contiunued Next Page -

*fac 3.9 ANSWER

a. 1. Loss of off-site power (LOP); ECCS premissives, no start. (0.75)

2. LOP followed by LOCA; LOCA signals override LOP load squencing, ECCS start automatically. (0.75)

3. LOCA followed by LOP; CS permissive, auto start on LOP. (0.75)

foc * (0.25)

b. ~~No~~, ~~there is a ten (10) minute interlock, to preclude operator intervention.~~ (0.25) [illegible] (0.25) ; take [illegible] (0.75)

(0.25 No, 0.5 for reason)

*Note: Yes also acceptable if reason corresponds properly

REFERENCE: R30 (Emerg. Diesel Gen. and Aux. System) pg. 46, 47

3.10 ANSWER

- If both recirc. pumps are running the logic is delayed for 2 seconds prior to select~~ing~~ the loop for injection. (0.5)
- If either or both pumps are NOT running then the logic is delayed for 0.5 seconds (0.25), after which a trip signal is given to both pumps.(0.25) (0.5)
- The logic then requires that reactor pressure be below 925 psig (0.25), before continuing to the 2 second time delay prior to loop selection.(0.25) (0.5)
- Loop selection is made by comparing the two riser pressures.(0.5) If loop 'A' riser pressure is greater than loop 'B' riser pressure by a preset differential then loop 'A' is selected.(0.25) If loop 'A' pressure IS NOT greater than loop 'B' pressure by the preset differential, then loop 'B' is selected for injection.(0.25) (1.0)

REFERENCE: INEL Exam Bank Question 5446
E11 (RHR) pg. 29, 30

fac. * 3.11 ANSWER 0.25 each

1. As long as the counts stay above 100 cps (0.5)
2. All the IRM's are on range eight or above (0.5)
3. [illegible]

REFERENCE: Fermi Exam Bank Question 3.07 (rewrite)

3.12 ANSWER

a. RHR pump A (0.5)

b. Provides signal of pump running to ADS logic (0.5)

c. F007A(B) will auto open if loop flow is <2200 gpm for 10 seconds if either pump is running in that loop as indicated by closure of pump breaker.(0.5) Will auto close on loop flow is > 2200 gpm.(0.5) (1.0)

REFERENCE: Fermi Exam Bank Question 3.21

- End of Section Three -

ADS DIV. II LOGIC (DIV. I LOGIC SIMILAR)

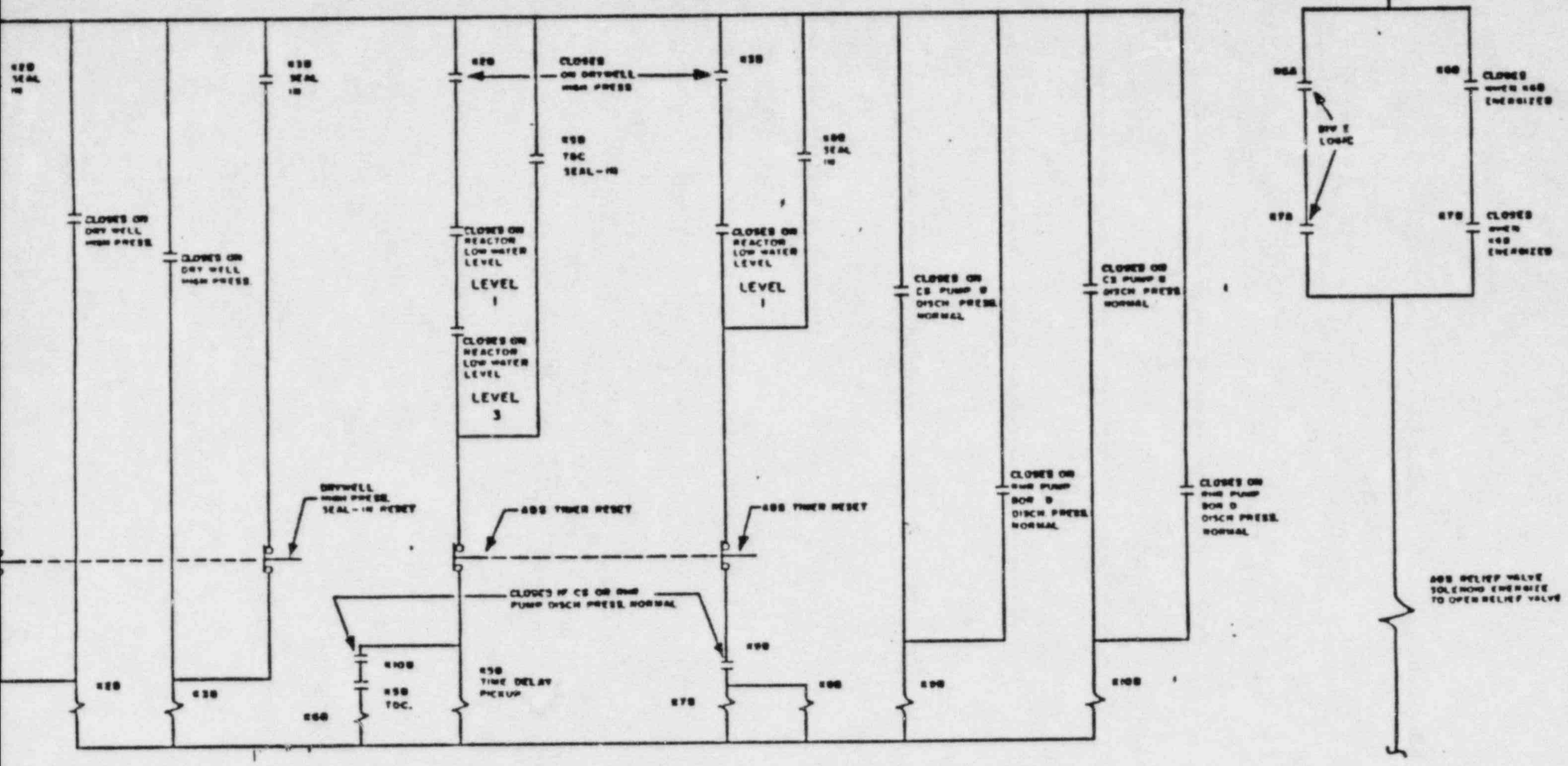


FIGURE 2

Ref Dwg (later)
03-15-42-01-A2

4.0 PROCEDURES: NORMAL, ABNORMAL, EMERGENCY, AND RADIOLOGICAL CONTROL

4.1 ANSWER

1. Verify automatic actions
2. Depress both manual scram pushbuttons
3. Verify reactor power is decreasing
4. Place mode switch in refuel and verify all control rods are in
5. Place Rx mode switch to shutdown
6. Maintain water level between level 3 and level 8
7. Maintain reactor pressure between 900 psig and 1075 psig
8. Insert SRM and IRM detectors and range the IRMs
9. Trip the main turbine
10. Verify recirculation pumps have run back to min. speed
11. Run program OD7, Option 2
12. Notify S.S. and may require classifying in the EPIP EP-101

(Any 8 for full credit) (2.0)

REFERENCE: AOP 20.000.21 pg. 1, 2

4.2 ANSWER

1. Avoid possibility of "fooling" LPCI loop selection logic (1.0)
2. Back flow through idle or reduced flow jet pumps can cause jet pump vibration and therefore unnecessary stress on jet pump components. (1.0)
3. Provides for some coastdown flow from the unbroken loop during a ~~long~~ break accident. (1.0)
   line

REFERENCE: B31 (RFC) pg. 9, 10 Rev. 3
T.S. 3.4.1.3

4.3 ANSWER

a. 1. If the SRV cannot be closed within two (2) minutes (0.5)
   2. If torus temperature exceeds 95°F. (0.5)

b. 1. Decrease recirc. flow to minimum (0.5)
   2. Place mode switch to shutdown (0.5)

REFERENCE: AOP - 20.000.25, Pg. 1

- Section Four Continued Next Page -

4.4 ANSWER

1. Read the RWP (0.25), and resolve question (0.25) (0.5)
2. Sign (0.25), "RWP Acknowledgement Log Sheet" (0.25) (0.5)
3. Review copy of RWP (0.25), at work area (0.25) (0.5)

REFERENCE: ~~T.S. 3.7.1.2. pg. 3/4 7-3~~
AP 12.000.13 pg. 10

4.5 ANSWER

a. 1. Reactor power cannot be determined. (0.5)

2. Reactor power > 6% (0.5) and torus water temperature reaches 110°F (0.5). (1.0)

*4a b. To concentrate the boron liquid. (0.25) [illegible] (0.25) (0.5)

c. When the SLC tank level indicates zero (0.5)

REFERENCE: EOP 29.000.08, pg. 1-4

4.6 ANSWER

CONDITION	MODE SWITCH POSITION	AVERAGE REACTOR COOLANT TEMPERATURE	
1. POWER OPERATION	Run	Any Temperature	(0.5)
2. STARTUP	Startup/Hot Standby	Any Temperature	(0.5)
3. HOT SHUTDOWN	Shutdown	> 200°F	(0.5)
4. COLD SHUTDOWN	Shutdown	< 200°F	(0.5)
5. REFUELING	Shutdown or Refuel	≤ 140°F	(0.5)

(0.25 for mode position and 0.25 for temperature)

REFERENCE: Technical Specification

4.7 ANSWER

*6a. a. When the nitrogen purging gas pressure remains constant. or [illegible] (1.0)

b. Gas expansion lower the temperature and you must wait for it to come to ambient equilbrium. (1.0)

REFERENCE: SOP 23.106 pg. 9, 10

- Section Four Continued Next Page -

4.8 ANSWER

1. Torus water level > +2" (124,220 ft3)
2. torus water level < -2" (121,080 ft3)
3. Torus water average temperature > ~~135°F~~ [illegible] * fac.
4. Drywell atomsphere average temperature > 135°F
5. Drywell pressure > ~~1.68~~ 1.93 psig gave 1.86 correct — * fac.

(0.25 each condition, 0.25 each setpoint) (2.5)

REFERENCE: EOP 29.000.03, pg. 1

4.9 ANSWER

1. Time (0.5)
2. Critical rod position information, rod sequence, rod group, rod and rod position. (0.5)
3. Reactor coolant temperature (0.5)
4. Reactor perioa (0.5)

* new procedure REFERENCE: GOP 22.000.03, pg. 6 (Startup from Cold Shutdown)

4.10 ANSWER

a. 2 (0.5)

b. 1. Misoperation in automatic is confirmed(0.5)
   2. Adequate core cooling is assured.(0.5) (1.0)

c. Will not auto initiate (0.5)

REFERENCE: SOP 23.205, pg. 14

4.11 ANSWER

a. 3	(0.5)
b. 5	(0.5)
c. 2	(0.5)
d. 1	(0.5)
e. 4	(0.5)

REFERENCE: FERMI Exam Bank Question 4.08

4.12 ANSWER

High hydraulic forces. (0.5)

REFERENCE: FERMI Exam Bank Question 4.12

- End of Section Four -

- END OF EXAM -

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

FACILITY: FERMI 2

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 85/02/12

EXAMINER: LANG, T.

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
25.00	24.88			5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.50	25.37			6. PLANT SYSTEMS DESIGN, CONTROL, AND INSTRUMENTATION
25.00	24.88			7. PROCEDURES - NORMAL, ABNORMAL, EMERGENCY AND RADIOLOGICAL CONTROL
25.00	24.88			8. ADMINISTRATIVE PROCEDURES, CONDITIONS, AND LIMITATIONS
100.50	100.00			TOTALS

FINAL GRADE ________________%

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

____
APPLICANT'S SIGNATURE

GREGG OVERBECK

QUESTION 5.01 (1.50)

For the following conditions, state if the FUEL TEMPERATURE COEFFICIENT becomes more negitive or less negitive.

A. INCREASE in fuel temperature. (0.5)
B. INCREASE in moderator temperature. (0.5)
C. INCREASE in void fraction. (0.5)

QUESTION 5.02 (1.00)

Define the following terms:

A.Latent heat of vaporization. (0.5)
B.Steam Quality. (0.5)

QUESTION 5.03 (3.00)

Explain the effects of Increasing the following core parameters on steady state critical power.

A.Core Flow. (1.0)
B.Inlet Subcooling. (1.0)
C.Reactor Pressure. (1.0)

QUESTION 5.04 (2.50)

If equalibrium xenon is obtained (the reactor has been operated at constant power for many hours), and the reactor power is doubled, will the new equalibrium xenon consentration be twice as great? Explain your answer.

QUESTION 5.05 (3.00)

A.After making a rod notch with the reactor critical, you notice a 100 second period. How much reactivity was added by the rod notch? (assume BOL). (1.0)

B.After a reactor scram from power the shortest stable period possible is -80 seconds. Explain this statement. (1.0)

C.Is the initial period immediately following the scram shorter than -80 seconds? Explain your answer. (1.0)

QUESTION 5.06 (2.00)

A common misconception regarding rod worth is that, 'if the neutron flux increases in the vicinity of a rod, the rod worth (differential) of that rod increases.' Explain why this statement is incomplete in explaining rod worth.

QUESTION 5.07 (2.00)

A. What are four indications inside or outside the control room, which could be used to determine if a pump is cavatating? (1.0)

B. What is cavitation? (1.0)

QUESTION 5.08 (1.50)

SBLC is designed to reduce reactor power to zero level, while allowing the neuclear system to cool to room temperature with the control rods remaining withdrawn. To do this several positive reactivity effects must be over come. What are six of these effects?

QUESTION 5.09 (3.00)

You increase core power by pulling control rods around the center fuel bundle. Assuming that recirculation speed is kept constant, would the flow through the center bundle increase, decrease, or remain about the same? Explain your answer.

QUESTION 5.10 (2.50)

The Reactor is on a 100 second period. Moderator temperature is 160 deg F. With no operator action:

a. What is the associated reactivity at this period? (1.5)

b. What will be the moderator temperature when the reactor is again on an infinite period? (1.0)

Assume: BOL for time in Reactor Life.

State any assumptions you make.

SHOW ALL WORK.

QUESTION 5.11 (3.00)

The reactor is shutdown by 5% dk/k and the SRM's indicate 10 cps. If K eff of the reactor is increased to 0.98:

a. WHAT should be the approximate count rate? (Show all work.) (1.5)

b. What is the original K eff? (1.5)

QUESTION 6.01 (3.00)

What parameters will be indicated on the Rod Block Monitor meter with the meter switch in each of the following positions:

a. Input
b. Count
c. Reference
d. Block
e. Flow
f. Average (3.0)

QUESTION 6.02 (2.00)

Briefly describe the purpose of the following UPS switches:

A. Static Bypass Switch. (1.0)

B. Static Transfer Switch. (1.0)

QUESTION 6.03 (3.00)

With regard to the core spray system:

A. State the automatic initiation signals of the system. (1.0)

B. In the event that a Core Spray pump CMC switch is in OFF when an initiation signal is received, will placing the CMC switch in AUTO cause the pump to start? EXPLAIN. (1.0)

C. Which valve(s) receive a CLOSE signal from the Core Spray logic upon receipt of an initiation signal? (1.0)

QUESTION 6.04 (2.00)

Explain how the Logic of the Reactor Protection System is altered by installing the shorting links in the Neutron Monitoring System i.e., links installed verses links removed.

QUESTION 6.05 (2.50)

If during a unit start up you receive a spurious Group I:

A. What valves would you expect to close? (1.0)

B. What are six signals you would check to determine the cause of the Isolation? (1.5)

QUESTION 6.06 (3.50)

Which Reactor Feedpump trips provide for protection from:

A. Potential cavitation damage? (Three required for full credit). (1.5)

B. Potential turbine blading damage? (Four required for full credit). (2.0)

QUESTION 6.07 (3.00)

For each of the RCIC (Reactor Core Isolation Cooling) System component failures listed below, STATE WHETHER OR NOT RCIC WILL AUTO INJECT into the reactor vessel. IF IT WILL NOT INJECT, STATE WHY, AND IF IT WILL INJECT, provide ONE POTENTIAL ADVERSE EFFECT OR CONSEQUENCE OF system operation with the failed component. Assume NO OPERATOR ACTION, and the component is in the failed condition at the time RCIC receives the AUTO initiation signal. Consider each item seperately.

A. The Barometric Condenser VACUUM PUMP fails. (1.0)

B. The MINIMUM FLOW VALVE fails to AUTO open (STAYS SHUT) when system conditions require it to be open. (1.0)

C. The RCIC PUMP DISCHARGE FLOW ELEMENT OUTPUT SIGNAL (to the RCIC flow controller) is failed to its MAXIMUM output. (1.0)

QUESTION 6.08 (1.00)

State four(4) EMERGENCY DIESEL GENERATOR trips that WILL NOT shutdown the engine with an AUTO start condition present.

QUESTION 6.09 (3.00)

What are the conditions which will cause Recirculation Pump Run Back signals to be initiated. Be specific. Match speed limit to condition and state which runbacks must be reset manually. (Three required for full credit).

QUESTION 6.10 (2.50)

If you receive the following alarm:

```
*************************
*  APRM FLOW UNIT       *
*      INOP             *
*                       *
*************************
```

A. What AUTOMATIC action will result from the alarm? (0.5)

B. Other than the INOP, what are two (2) signals associated with the flow units which will cause the SAME automatic action to occur as in part 'a' above? (1.0)

C. What are two (2) conditions which will cause an INOP trip of a flow unit? (1.0)

QUESTION 7.01 (3.00)

What are the entry conditions for EOP 29.000.08 'Reactivity Control'?

QUESTION 7.02 (1.00)

According to procedure 20.129 (Loss of Station and/or Control Air Pressure) when are you required to manually scram the reactor?

QUESTION 7.03 (2.50)

List five (5) indications/symptoms of a jet pump malfunction.

QUESTION 7.04 (2.00)

If the Standby Liquid Control System is initiated, what are five (5) indications or parameters that should be checked or verified to insure the system is operating properly? (0.4 each)

QUESTION 7.05 (1.50)

If plant conditions are such that the control room must be evacuated, what are three (3) steps which should be performed prior to evacuating?

QUESTION 7.06 (2.00)

What must be done if MORE THAN ONE withdrawn control rod has an INOPERABLE SCRAM ACCUMULATOR while operating the plant at power?

QUESTION 7.07 (2.00)

With regared to EOP 29.000.08, REACTIVITY CONTROL:
If during a transient the Reactor fails to scram by a VALID scram signal, WHAT condition(s) require the initiation of the Standby liquid Control System and the isolation of the Reactor Water Cleanup System?

QUESTION 7.08 (1.50)

Under what conditions is an operator allowed to "DEFEAT THE AUTOMATIC ACTION OF AN ECCS"?

QUESTION 7.09 (2.50)

What are the entry conditions for EOP 29.000.03 "PRIMARY CONTAINMENT CONTROL"?

QUESTION 7.10 (3.00)

A reactor water isotopic analysis for iodine and specific activity is required when any of three (3) conditions occur. What are the three (3) conditons?

QUESTION 7.11 (1.00)

How is control rod coupling verified?

QUESTION 7.12 (1.00)

Reactor level indicatrors can be expected to__________.once drywell temperature reaches the reactor vesseld saturation temperature. (Choose one)

A. Read lower than actual vessel level.
B. Read higher than actual vessel level.
C. fail low.
D. fail to respond to level changes.

QUESTION 7.13 (2.00)

Regarding the RHR SOP 23.205 when operating in the SHUTDOWN COOLING MODE:

A. You are cautioned to NOT use Outboard Injection Valve E11-F017A/B to control cooldown rate. What adverse effects could result, according to this procedure? (1.0)

B. This procedure also cautions you to exercise care during one portion of a valve realignment to avoid RAPID DRAINING of the REACTOR VESSEL. Describe THREE FLOW PATHS associated with the RHR system that could result in RAPID DRAINING of the REACTOR VESSEL. (1.0)

QUESTION 8.01 (2.00)

BY PROC AND REVIEW TECH SPECS

A. If the reactor is operating at equal to or greater than ~~25%~~ 30% RATED THERMAL POWER and under a LIMITING CONTROL ROD PATTERN, what action would you take if a RBM were to fail? Be specific. (1.0)

B. What is a LIMITING CONTROL ROD PATTERN? (1.0)

QUESTION 8.02 (2.00)

A. If a temporary procedure change is required on the backshift, who must sign the 'Temporary Procedure Change Request'? (1.0)

B. What limitations are placed on making temporary changes? (1.0)

QUESTION 8.03 (2.50)

A. On shift operations personnel and security are granted UNLIMITED ACCESS to the control room. What are four (4) others (by title) who are also granted UNLIMITED ACCESS? (2.0)

B. Who has authority to EXCLUDE non-essential personnel from the control room when their presence is hampering the operation of the control room? (0.5)

QUESTION 8.04 (2.00)

What are the Technical Specification limits for Reactor Coolant System leakage?

QUESTION 8.05 (2.00)

Define the following terms.

A. Core Alteration. (1.0)

B. Shutdown Margin. (1.0)

QUESTION 8.06 (1.00)

Regarding the TECHNICAL SPECIFICATION curves for MINIMUM TEMPERATURE FOR CRITICAL operation:

A. What could happen if critical operation was conducted LESS THAN the minimum temperature specified? (1.0)

B. Is this temperatrure expected to change over core life and if so, why? (1.0)

QUESTION 8.07 (3.00)

Briefly explain WHY each of the following RECIRCULATION PUMP STARTING LIMITATIONS are necessary:

A. The pump in an idle recirculation loop shall not be started unless the temperature of the coolant within the idle and operating loop are within 50 degrees F of each other. (1.0)

B. When in one pump operation, the idle pump shall not be started unless the active pump speed is reduced to less than 50% rated speed. (1.0)

C. Recirculation loop flow mismatch shall be maintained within 10% of rated recirculation flow with core flow less than 70% of rated core flow. (1.0)

QUESTION 8.08 (2.00)

As per Technical Specification definition, what is the difference between Hot Shutdown and Hot Standby?

QUESTION 8.09 (2.00)

The statements below define each of the four (4) emergency classifications. Match the classification (i.e., SITE AREA EMERGENCY, UNUSUAL EVENT, GENERAL EMERGENCY, OR ALERT) aplicable to each statement.

A. Does not require activation of the emergency centers (TSC, or EOF or OSC). (0.5)

B. Major failures of plant functions needed for protection of the public, but the release is not expected to exceed the upper PAG's (5 rem whole body, 25 rem thyroid.) (0.5)

C. Limited release of radioactivity in excess of Tech. Specs. limit is probable. Does not require protective actions be recommended to the state and county authorities. (0.5)

D. A release of airborne activity which results in off-site exposures in excess of the limits specified in the USEPA Protective Action Guides. (0.5)

QUESTION 8.10 (2.00)

Regarding Limiting Conditions for Operation, 3.6.2.1, for Suppression Chamber:

The maximum average temperature during Operational Conditions 1 or 2 is ____ degrees F, except that the maximum average temperature may be permitted to increase to____ degrees F during testing which adds heat to the suppression chamber or to ____ degrees F with thermal power less than or equal to 1% of RATED THERMAL POWER or to ____ degrees F with the MSIV's closed following a scram.

QUESTION 8.11 (1.50)

The reactor at Fermi 2 has several power distribution limits. One of these is Linear Heat Generation Rate.

A. What is the limit for LHGR? (0.5)

B. When does this limit apply? (0.5)

C. What must be done if this limit is exceeded? (0.5)

QUESTION 8.12 (1.50)

Answer the following questions as they pertain to Containment Systems Tech. Specs.:

A. How many Suppression Chamber-- Drywell Vacuum Breakers are required to be operable in Operational Condition 3? (0.5)

B. How many Reactor Building -- Suppression Chamber Vacuum Breakers are required to be operable in Operational Condition 3? (0.5)

C. When must the Drywell atmosphere be less than 4% Oxygen by volume? (0.5)

QUESTION 8.13 (1.50)

Regarding PLANT STARTUPS:

A. Who must REVIEW the REACTOR STARTUP MASTER CHECKOUT 22.000.01 upon completion? (0.5)

B. In the REACTOR STARTUP MASTER CHECKOUT, who determines which systems are required to be lined up? (0.5)

C. Following a reactor SCRAM, who has responsibility for authorizing a return to power? (0.5)

ANSWER 5.01 (1.50)

A.less
B.more
C.more .5 each

REFERENCE
Fermi Question Bank (5.02)

ANSWER 5.02 (1.00)

A.Energy necessary to convert a unit of a substance from a saturated liquid to a saturated vapor. (0.5)

B.The ratio of the mass of steam to the mass of the total fluid.

$$x = \frac{M(steam)}{M(steam)+M(liquid)}$$ (0.5)

REFERENCE
Fermi Question Bank (5.08)

ANSWER 5.03 (3.00)

A.Increasing core flow will cause critical power to increase due to the increase heat removal capability. (1.0)

B.Increasing subcooling causes an increase in critical power. The inlet enthalpy will be reduced and the heat which can be removed will increase. (1.0)

C.Increasing Reactor Pressure reduces the energy to be at critical quality therefore critical power will be lower. (1.0)

REFERENCE
Fermi Question Bank (5.09)

ANSWER 5.04 (2.50)

No. The production rate is directly proportional to power level, but removal rate is proportional to xenon concentration and it contains a power dependent term, thermal neutron flux. Since flux is directly proportional to power level the burnout term becomes more significant. This results in an equalibrium xenon value which is higher than the original value, but not twice as high.

REFERENCE
Fermi Question Bank (5.14)

ANSWER 5.05 (3.00)

A.
T=B-p/xp so p =B/xT+1 x=Lambda
assume B=.0072 (BOL)
p=.0072/(100)(0.1)+1=6.545 x 10E-4 delta k/k (1.0)

B. After the initial prompt drop, power can not decrease faster than the longest lived delayed neuton appears. (1.0)

C. Yes The initial drop in power will only be due to the prompt neutrons. (1.0)

REFERENCE
General Theory

ANSWER 5.06 (2.00)

The worth depends on the neutron flux in its location compared to the average neutron flux in the core. Thus, as power is increased, the flux also increases. This will increase the worth of the rod if the local flux is increased more than the core average flux.

REFERENCE
General Theory

ANSWER 5.07 (2.00)

A.Vibration, noise, lower or fluctuating amperage/flow/discharge pressure. (1.0)

B.The formation of bubbles of steam in the suction of a pump due to operation with insuffiecent pressure. The bubbles collapse in the volute or high pressure region. (1.0)

REFERENCE
General Theroy

ANSWER 5.08 (1.50)

Any six for full credit.
A.Complete decay of rated power xenon inventory.
B.The elemination of steam voids.
C.The changing water density from hot to cold.
D.Reduced doppler effect.
E.The reduced neutron leakage from boiling to cold.
F.Decreased control rod worth as moderator cools.
G.Suffiecent reactivity added to insure shutdown margin met. /OVERCOME POSITIVE REACTIVITY DUE TO [illegible] FULLY WITHDRAWN.

REFERENCE
General Theory

ANSWER 5.09 (3.00)

Once the control rods are pulled steam forms in the coolant channel, it forces a volume increase in the coolant, the more steam the greater the volume. The greater the volume, the greater the frictional pressure drop must be in the channel. But the pressure drop across the core can not be changed by any one bundle. The pressure drop across a bundle is locked between the pressure in the lower plenum and the pressure inside the shroud. This means that as power and consequently steam production are increased in the bundle, the pressure drop can not change. If the pressure drop can not change then flow must decrease. Core orificing was installed to minimize the effects of two phase flow. As the pressure drop due to two phase flow increases bundle flow decreases. However, as bundle flow decreases the pressure drop across the orifice decreases. The total effect is that bundle flow will remain about the same.

NOTE: Shorter explainations would be excepted.

ANSWER 5.10 (2.50)

Assumptions: Lambda = 0.1 sec -1 (given)
Beta Bar = 0.0070 (0.25)
Alpha T = -1 X 10 E-4 (0.25)
Period = 100 sec (given) (0.5)

T = (B-p)/(.p): solve for p: p = B/1+T.:

p = 0.0070 / 1 + 100 X 0.1: p = 6.3 X 10 E-4 delta K/k (1.0)

NOTE: The second part will be graded independently of the first part.

delta T mod = p / alpha T
= 6.3 X 10 E-4 delta K/K / 1 X 10 E-4 delta K/K deg F
= 6.3 deg F

Moderator Temp = 160 deg F + 6.3 deg F = 166.3 deg F (1.0)

REFERENCE
Reactor Theory

ANSWER 5.11 (3.00)

Formulas:
p = (Keff - 1)/Keff
-.05 = (Keff-1)/Keff
-.05 = 1 - 1/Keff
-1.05 = -1/Keff
-1.05/Keff = -1
Keff = -1/-1.05
Keff = .952 (1.5)

CR1(1-Keff1) = CR2(1-Keff2)
10(1-.952) = CR2(1-.98)
10(1-.952)/1-.98 = CR2
.48/.02 = CR2
24 = CR2 (1.5)

(The two calculations will be graded seperately)

REFERENCE
Reactor Theory

ANSWER 6.01 (3.00)

a. Input: Any of the LPRM inputs
b. Count: The number of LPRM inputs which are operable
c. Reference: The reference APRM input
d. Block: The trip level reference
e. Flow: The flow input to the slope and bias circuit
f. Average: The RBM channel output
(0.5 each) (3.0)

REFERENCE
RBM Lesson Plan

ANSWER 6.02 (2.00)

A. Transfers load to an alternate AC supply should the inverter voltage drop below a pre-set level. ~~Must be manually reset to restore normal power supply.~~ QUESTION ONLY ASK FOR PURPOSE, NOT HOW RESET

B. Automatically transfers the load from the inverter to the voltage regulator ~~if any of the following exist:~~ [illegible] FAULT

X 1. Undervoltage
   a) slow
   b) fast

QUESTION ONLY ASK FOR PURPOSE, NOT WHAT CONDITIONS

2. Abnormal Frequency

3. Overload

REFERENCE
Fermi Question Bank (6.36)

ANSWER 6.03 (3.00)

A. Rx low low low level-level 1 , HIGH DRYWELL PRESSURE (1.0)

B. No. The CMC will have to be placed in RUN to cause the CS pump to start. The 'Manual Override Seal-In' indicator above the pump CMC will be illuminated. (1.0)

C. Full flow test valves, F015A/B. (1.0)

REFERENCE
Fermi Questin Bank (6.37)

ANSWER 6.04 (2.00)

With shorting links installed:
A.SRM Hi-Hi scram is bypassed (0.5)
B.Neutron Monitoring System for RPS is 'one out of two twice'logic. (0.5)

With shorting links removed:
Any one of the 4 SRMs, or; any one of the 8 IRMs, or; any one of the 6 APRMs is capable of imposing scrams if their trip points are exceeded i.e. non-coincident logic. (1.0)

REFERENCE
Fermi Question Bar (6.28)

ANSWER 6.05 (2.50)

A. MSIV's (0.5)
MSL Drain Isolation valves. (0.5)

B. 1. RPV low-low level Any six for full credit.
2. Main steamline high radiation
3. High steamline flow
4. High steamline tunnel temperature
5. Low steamline pressure
6. Condenser high pressure
7. Turbine building high area temperature (tunnel) (0.25 each)

REFERENCE
Fermi Question Bank (6.19)

ANSWER 6.06 (3.50)

A. Main condenser hotwell level low.
All heater feedpumps off.
Feedpump suction pressure low. (0.5 each)

B. Exhaust hood temperature high.
Exhaust hood pressure high.
Overspeed.
Reactor vessel water level high. (0.5 each)

REFERENCE
Fermi Question Bank (6.20)

ANSWER 6.07 (3.00)

A. Will inject. Turbine seal leakage resulting in potential airborne activity in the RCIC room. (1.0)

B. Will inject. Pump overheating and seal damage result during low or non-flow conditions. (1.0)

C. Will not inject. Maximum signal from the flow element will result in the flow controller keeping the turbine speed at minimum. (1.0)

REFERENCE
Fermi Question Bank (6.16)

ANSWER 6.08 (1.00)

~~Any four for full credit. (.25 each)~~
~~1. Low lube oil pressure.~~
~~2. Overspeed.~~
~~3. High crankcase pressure.~~
~~4. Generator differential.~~
~~5. Overcrank (time delay).~~

Any four for full credit
1. Field Failure
2 Over voltage
3. Generator Ground
4. Jacket Coolant Level Low
5. Jacket Coolant Pressure Low
6. Jacket Coolant Temperature High
7. Fuel Oil pressure Low
8. Lube Oil Temperature High

REFERENCE
Fermi Question Bank (6.17)

ANSWER 6.09 (3.00)

A. Feedwater flow decrease below 20% or discharge valve not full open, runback to minimum speed, 30% -- signal ~~auto reset.~~ not required (1.0)

B. Reactor level decrease below level 4 and RFP trip, runback to 45% speed, signal manually reset. [illegible] (1.0)

C. Loss of heater drains, runback to 80% speed, signal manually reset.(1.0)

REFERENCE
Fermi Question Bank (6.15)

ANSWER 6.10 (2.50)

A. An alarm and a Rod Block will be generated.

B. > 10% difference between two flow units. ◀ Set point values not asked for.
High flow (108%).

C. Module unpluged.
Mode switch out of operate.

REFERENCE
Fermi Question Bank (6.08)

ANSWER 7.01 (3.00)

A. Receipt of a full scram signal and sustained APRM indication is greater than or equal to 6%. (1.0)

B. Receipt of a full scram signal and more than one rod does not insert to position 04 or less. (1.0)

C. Recept of a full scram signal and reactor power cannot be determined. (1.0)

REFERENCE
Fermi Question Bank (7.44)

ANSWER 7.02 (1.00)

When the scram air header low pressure alarms annunciates and more than one control rod drift alarm is received.

REFERENCE
Fermi Question Bank (7.42)

ANSWER 7.03 (2.50)

Any five for full credit.

1. Unplanned change in core flow.
2. Unplanned change in recirculation loop flow.
3. Unplanned decrease in core differential pressure.
4. A jet pump percent differential pressure deviates excessively from the average of the remaining pumps.
5. Unplanned decreased in reactor power.
6. Unplanned decrease in MWE output.

REFERENCE
Fermi Question Bank (7.39)

ANSWER 7.04 (2.00)

A. Loss of squib valve continuity. lights
B. Injection check valves indicate open.
C. Pump run indication (run light and amps).
D. Tank level decreasing.
E. Power decreasing. (0.4 each)
F. Loss of squib valve continuity annunciator
G. RWCU outboard isolation valve closes
I Pump Discharge Pressure developed

Reference SOP 23.139 Rev
AOP 20.139.01

REFERENCE
Fermi Question Bank (7.36)

ANSWER 7.05 (1.50)

A. Place the mode switch in SHUTDOWN.
B. Depress both manual scram pushbuttons.
C. Arm and depress the main turbine trip pushbuttons.

REFERENCE
Fermi Question Bank (7.34)

ANSWER 7.06 (2.00)

A. Declare the rods inop and immediately; (0.5)
B. Verify one CRD pump is operating by inserting a withdrawn control rod at least one notch, (0.5)
OR
Place the Mode Switch in the SHUTDOWN position. (0.5)
C. Insert inop rods and disarm electrically and manually. (0.5)

REFERENCE
Fermi Question Bank (7.20)

ANSWER 7.07 (2.00)

A. If Rx power cannot be determined (0.5)
OR
B. If MSIV's closed--or--condenser not available (0.5)
AND
Rx power greater than or equal to 6% (0.5)
AND
Torus temperature reaches 110 degrees F (0.5)

REFERENCE
Fermi Question Bank (7.16)

ANSWER 7.08 (1.50)

Confirm by at least two independent indications that: (0.5)
1. Misoperation in auto initiated; or (0.5)
2. Adequate core cooling is assured. (0.5)

REFERENCE
Fermi Question Bank (7.14)

ANSWER 7.09 (2.50)

Five for full credit.

A. Torus water level above +2, (~~124,430 Ft3~~)
B. Torus water level below -2, (~~120,800 Ft3~~)
C. Torus water average temperature above 95 degrees F
D. Drywell atmosphere average temperature above ~~138~~ degrees F 135°F
E. Drywell presure above ~~1.93~~ 1.88 psig. (0.5 each)

Ref 29.000.03 [illegible]

REFERENCE
Fermi Question Bank (7.10)

ANSWER 7.10 (3.00)

LCO exceeded and:

A. Thermal power changed by more than 15% of rated thermal power in one hour, or

B. The off-gas level, at the delay pipe, increased by more than 10,000 microcuries per second in one hour during steady state operation at release rates less than 75,000 microcuries per second, or

C. The off-gas level, at the delay pipe, increased by more than 15% in any one hour during steady state operation at release rates grater than 75,000 microcuries per second.

REFERENCE
Fermi Question Bank (7.05)

ANSWER 7.11 (1.00)

~~A.~~ Verify 'FULL-OUT' indicator ~~is illuminated~~ and position indicator indicates ~~'48'~~. not [illegible] ~~(0.5)~~

~~B.~~ Attempt to withdraw each control rod to the OVERTRAVEL position. (.25)
Verify control rod is coupled by:
1. Observing 'stall flow' (.25)
2. Rod settling back to position 48. (.25)
3. 'OVERTRAVEL' light extinguished. (.5) ~~(1.0)~~ ~~(0.5)~~

REFERENCE
Fermi Question Bank (7.02)

ANSWER 7.12 (1.00)

B. Read higher than actual vesses level.

REFERENCE
Fermi Question Bank (7.50)

ANSWER 7.13 (2.00)

A. Thermal stratification, improper mixing, loop temperatures appear normal, could result in exceeding 200 degrees F and possibly pressurize the vessel. (1.0)

B. Through the shutdown cooling suction and out through the suppression pool suction. Through the shutdown cooling suction and out through the RHR pump minimum flow line. Through the shutdown suction and out through the full flow test valve. (1.0)

REFERENCE
Fermi Question Bank (7.12)

ANSWER 8.01 (2.00)

A. For failure of a single RBM channel:

1. Verify not operating on a Limiting Control Rod Pattern (0.5)

AND

2. Restore the inop RBM channel to operable within 24 hours. (0.5)

OR

1. Place the inop RBM in a tripped condition within the next hour. (1.0)

B. A rod pattern which exists that should a control rod be moved out of the core, the core would be placed on a thermal limit.

REFERENCE
Fermi Question Bank (8.03)

ANSWER 8.02 (2.00)

A. Two cognizant members of plant staff- one with an SRO license. (1.0)

B. 1. Must not change the intent of the procedure. (0.33)

2. Must be approved by OSRO within 14 days. (0.33)

3. <=5 changes per procedure. (0.33)

REFERENCE
Fermi Question Bank (8.05)

ANSWER 8.03 (2.50)

A. Plant Superintendent.
Assistant Plant Superintendent.
Operating Engineer.
Assistant Operating Engineer. (0.5 each)

B. NSS may exclude personnel. (0.5)
~~NSO may request NSS to exclude personnel.~~ (0.25 each)

QUESTION DOES NOT ASK WHO
[illegible]

REFERENCE
Fermi Question Bank (8.07)

ANSWER 8.04 (2.00)

A. No pressure boundary leakage.
B. 5 gpm unidentified leakage.
C. 25 gpm total leakage average over any 24 hour period.
D. 1 gpm leakage at an RCS pressure through valves.
E. 2 gpm increase in Unidentified Leakage.
(0.4 each)

REFERENCE
Fermi Question Bank (8.10)

ANSWER 8.05 (2.00)

A. The addition, removal, relocation, or movement of fuel, sources, incore instruments or reactivity controls within the reactor pressure vessel with the head removed and fuel in the vessel. (Suspension of Core Alteration shall not preclude completion of the movement to a safe conservative position. (1.0)

B. SDM shall be the amount of reactivity by which the reactor is or would be subcritical assuming all control rods are fully inserted except for the single control rod of the highest reactivity worth which is assumed to be fully withdrawn and the reactor is in the shutdown condition, cold, xenon free. (1.0)

REFERENCE
Fermi Question Bank (8.11)

ANSWER 8.06 (1.00)

A. Brittle fracture of reactor pressure vessel could occur. (0.5)
B. Yes. Due to neutron embrittlement. (0.5)

REFERENCE
Fermi Question Bank (8.13)

ANSWER 8.07 (3.00)

A. Prevents undue stress on the vessel nozzles and bottom head region. (1.0)

B. Prevents creation of abnormal conditions in the idle loop jet pumps (vibration) (1.0)

C. To insure an adequate core flow coastdown from either recirculation pump following a LOCA -- prevent 'fooling' LPCI Loop Selection Logic. (1.0)

REFERENCE
Fermi Question Bank (8.18)

ANSWER 8.08 (2.00)

HOT S/D --MSS in S/D and >200 degrees F. (1.0)
HOT S/B---MSS in S/U -- HOT S/B and any temperature. (1.0)

REFERENCE
Fermi Question Bank (8.22)

ANSWER 8.09 (2.00)

1. Unusual Event.
2. ~~Alert.~~ SITE AREA EMERGENCY
3. ~~Site Emergency.~~ ALERT
4. General Emergency. (0.5 each)

REFERENCE
Fermi Question Bank (8.27)

ANSWER 8.10 (2.00)

....95....105....110.....120.

REFERENCE
Fermi Question Bank (8.35)

ANSWER 8.11 (1.50)

A. 13.4 kw/ft
B. Operational Condition 1>= 25% of RTP
C. Take actions within 15 min. to restore LHGR to within limits (within 2 hours or reduce power to < 25% of RTP).
(0.5 each)

REFERENCE
Fermi Question Bank (8.40)

ANSWER 8.12 (1.50)

A. 10
B. 2
C. Within 24 hours after attaining 15% reactor power following a S/U to within 24 hours prior to decreasing power below 15% on a scheduled Rx. shutdown.
(0.5 each)

REFERENCE
Fermi Question Bank (8.36)

ANSWER 8.13 (1.50)

A. NSS (0.5)
B. OE (0.5)
C. ~~Cause known--- NSS~~ Procedure 21.000.03 (0.25)
Cause unknown---Plant Superintendent. (0.25)

REFERENCE
Fermi Question Bank (8.12)