APPENDIX

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

Operator Licensing Exam Report: 50-298/OL 88-02 Operating License: DPR-46

Docket No: 50-298

Licensee: Nebraska Public Power District
P. O. Box 499
Columbus, Nebraska 68601

Facility Name: Cooper Nuclear Station (CNS)

Examination at: CNS

Chief Examiner: John L Pellet 8/9/88
J. L. Pellet, Chief Date
Operator Licensing Section
Division of Reactor Safety

Approved by: John L Pellet 8/9/88
J. L. Pellet, Chief Date
Operator Licensing Section
Division of Reactor Safety

Summary

NRC Administered Examinations Conducted During the week of July 18, 1988
(Report 50-298/OL 88-02)

NRC administered examinations to two candidates. Both candidates passed all portions of the examination and will be issued the appropriate license.

DETAILS

1. Persons Examined

		SRO	RO
License Examinations:	Pass	1	1
	Fail	0	0

2. Examiners

J. Pellet, Chief Examiner

3. Examination Report

Performance results for individual examinees are not included in this report as it will be placed in the NRC Public Document Room and these results are not subject to public disclosure.

a. Examination Review Comment/Resolution

In general, editorial comments or changes made during the examination, or subsequent grading reviews are not addressed by this resolution section. No comments were submitted for this examination.

b. Site Visit Summary

(1) At the end of the written examination administration, the facility licensee was provided a copy of the examinations and answer keys for the purpose of commenting on the examination content validity. It was explained to the facility licensee that regional policy was to have examination finalized within 30 days. Thus, a timely response was desired to attain this goal.

(2) At the conclusion of the site visit, the examiners and site NRC personnel met with facility representatives to discuss the visit. The following individuals were present:

NRC	FACILITY
J. Pellet (Chief Examiner)	J. Boyd
	R. Brungardt
	J. Dutton
	G. Reece
	J. Surette

Mr. Pellet opened the meeting by thanking those present for the cooperation received during the site visit. Those present were also informed that current guidelines do not allow disclosure of preliminary operating examination results. Other items discussed were as follows:

(a) Several trainees were in the control room during the operating test. This should be avoided in the future since it can interfere with the candidate, plus it adds additional pressure through the presence of more observers.

(b) The EOPs were confusing when applied to a complex, multiple failure event. Proper usage required that as many as four sections of the EOPs be conducted simultaneously.

(c) The EOPs appear to provide only minimal guidance on prioritization of mitigation efforts. For example, whether an operator should permit core reflood with cold water when the reactor has not made subcritical appears to be only indirectly addressed.

(d) Operator licensing program changes were discussed, including the generic fundamentals examination, the new requalification audit process, and the examiners handbook.

c. Generic Comments

Due to the small number of examinees, no generic strengths or weaknesses were identified.

d. Master Examination and Answer Key

A copy of the final CNS written examination and answer key is attached.

e. Facility Examination Review Comments

No facility licensee review comments regarding the CNS written examination were submitted.

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

FACILITY: COOPER

REACTOR TYPE: BWR-GE4

DATE ADMINISTERED: 88/07/19

EXAMINER: PELLET, J.

CANDIDATE: ____________________

INSTRUCTIONS TO CANDIDATE:

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	CANDIDATE'S SCORE	% OF CATEGORY VALUE	CATEGORY
25.00	100.00	________	________	5. THEORY OF NUCLEAR POWER PLANT OPERATION, FLUIDS, AND THERMODYNAMICS
25.00		________ Final Grade	________%	Totals

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

____
Candidate'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 on 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 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 5.01 (1.00)

The reactor trips from full power, equilibrium XENON conditions. Twenty--four (24) 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? (1.0)

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 follows its normal decay rate.

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

QUESTION 5.02 (1.00)

Which one of the following most accurately decribes when Control Rod Worth, during a REACTOR STARTUP, would normally be at its MAXIMUM? (1.0)

a. Cold Shutdown

b. Heatup in Progress (~ 1% reactor power, 350 deg's F)

c. Heatup Complete (~ 1% reactor power, 550 deg's F)

d. 50% Reactor Power

e. 100% Reactor Power

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

QUESTION 5.03 (1.00)

A temperature instrument with an out-of-date calibration sticker on it is reading 400 deg F. A recently calibrated pressure gauge, sensing the same SATURATED system, indicates 350 psig. Which of the following is the actual tank temperature? (1.0)

a. 428 deg's F

b. 432 deg's F

c. 436 deg's F

d. 440 deg's F

QUESTION 5.04 (1.00)

WHICH ONE of the following is the QUALITY of a 540 deg F vapor-liquid mixture whose specific enthalpy is 1175 BTU/lbm? (1.0)

a. 0.559

b. 0.816

c. 0.964

d. 0.971

QUESTION 5.05 (1.00)

Which of the following isotopes found in the reactor coolant would NOT normally be measured to estimate the size of a fuel cladding leak? (1.0)

a. Co - 60

b. Xe - 133

c. I - 131

d. Kr - 87

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

QUESTION 5.06 (1.00)

A reactor heat balance was performed (by hand) during the shift due to the Process Computer being out of service. Which of the following statements is TRUE concerning recctor power? (1.0)

a. If the core flow rate was LOWER than the actual core flow rate, then the actual power is HIGHER than the currently calculated power.

b. If the reactor recirculation pump heat input was OMITTED, then the actual power is HIGHER than the currently calculated power.

c. If the steam flow was LOWER than the actual steam flow, then the actual power is HIGHER than the currently calculated power.

d. If the RWCU return temperature was LOWER than the actual RWCU return temperature, then the actual power is HIGHER than the currently calculated power.

QUESTION 5.07 (1.00)

Which of the following best defines the point of adding heat (POAH)? (1.0)

a. When the fission RATE is sufficient to cause fuel temperature to increase.

b. During sub-critical multiplication when Keff is > 0.99.

c. When ALL heat additions overcome heat losses.

d. When reactivity due to voids exceeds the reactivity due to temperature.

QUESTION 5.08 (1.00)

Which of the following is correct? (1.0)

a. As void fraction increases, the moderator density decreases resulting in a positive reactivity effect.

b. The void coefficient is inversely proportional to the effective size of the core.

c. The value of the void coefficient is NOT related to the moderator to fuel ratio.

d. The value of the void coefficient is NOT affected by fuel temperature increases except during the extreme temperatures reached during an accident.

QUESTION 5.09 (1.00)

Which of the following thermal limits protects the fuel from clad rupture due to PLASTIC STRAIN (deformation)? (1.0)

a. APLHGR

b. LHGR

c. MCPR

d. MAPRAT

QUESTION 5.10 (1.00)

The fuel temperature (Doppler) coefficient becomes: (1.0)

a. Less negative with fuel burnup, and more negative with control rod withdrawal.

b. More negative with fuel temperature increase and less negative with void fraction increase.

c. Less negative with control rod withdrawal, and more negative with fuel temperature increase.

d. More negative with void fraction increase and less negative with fuel temperature increase.

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

QUESTION 5.11 (1.00)

The reactor is critical at 100 cps. Which of the following BEST describes the behavior of neutron power following a prompt insertion of negative reactivity? (1.0)

a. Neutron power drops immediately to "Beta" (delayed neutron fraction) times the neutron power prior to the prompt insertion of negative reactivity.

b. Neutron power decreases linearly with time after the initial prompt drop.

c. After the initial prompt drop, neutron power decreases on a constant negative period; the magnitude of the period determined by the amount of negative reactivity inserted.

d. Because only delayed neutrons are left immediately after a negative reactivity insertion, neutron power decreases on an 80 second period regardless of the size of the negative reactivity insertion.

QUESTION 5.12 (1.00)

Reactivity is defined as which of the following? (1.0)

a. The ratio of the number of neutrons at some point in this generation to the number of neutrons at the same point in the previous generation.

b. The fractional change in neutron population per generation.

c. The factor by which neutron population changes per generation.

d. The rate of change of reactor power in neutrons per second.

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

QUESTION 5.13 (1.00)

Which of the following describes the total amount of reactivity that must be added to bring a reactor to a critical condition? (1.0)

a. Reactivity Defect

b. Excess Reactivity

c. Subcritical Factor

d. Shutdown Margin

QUESTION 5.14 (1.00)

Which of the following is correct concerning control rod worth during a reactor startup with 100% peak Xenon versus a startup with Xenon free conditions? (1.0)

a. Peripheral control rod worth will be LOWER during the 100% peak Xenon startup than during the Xenon free startup.

b. Central control rod worth will be HIGHER during the 100% peak startup than during the Xenon free startup.

c. Peripheral control rod worth will be HIGHER during the 100% peak Xenon startup than during the Xenon free startup.

d. Both central and peripheral control rod worths WILL BE THE SAME regardless of core Xenon concentration.

QUESTION 5.15 (1.00)

What is the reactor period when, during a reactor startup, the IRM readings go from 30% to 65% on the same range in 2 minutes? (1.0)

a. 120 seconds

b. 155 seconds

c. 173 seconds

d. 357 seconds

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

QUESTION 5.16 (1.00)

Which of the following best defines pump cavitation? (1.0)

a. The lack of sufficient system backpressure on the discharge side of the pump.

b. Pressure oscillations at the discharge of the pump due to excessive inlet pressure.

c. The formation and the subsequent collapse of vapor bubbles which cause erosion of the pump parts.

d. The existence of gas bubbles trapped in the pump housing causing flow oscillations.

QUESTION 5.17 (1.00)

What amount of reactivity is added if Keff is increased by control rod withdrawal from 0.880 to 0.965 in a subcritical reactor? (1.0)

a. 0.100 delta k/k

b. 0.085 delta k/k

c. 0.125 delta k/k

d. 0.136 delta k/k

QUESTION 5.18 (1.00)

Which is the correct description of the ONSET OF TRANSITION BOILING? (1.0)

a. The area on a heat transfer curve where the most energy is added to the coolant.

b. The condition where the fuel cladding becomes continuously blanketed with a vapor film causing the heat transfer coefficient of convection to drastically decrease.

c. The condition which causes the fuel cladding temperature to increase as the heat transfer coefficient of convection increases.

d. The condition which causes the fuel cladding temperature to fluctuate as the clad is alternately blanketed with steam and then rewetted with subcooled coolant.

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

QUESTION 5.19 (1.00)

Which of the following best describes why the coolant flow through a high power bundle will be less than the flow through a low power bundle without core orificing (1.0)

a. The channel quality increases.

b. The two phase flow friction multiplier decreases.

c. The fuel rods expand due to thermal effects.

d. The bypass flow increases.

QUESTION 5.20 (1.00)

Which of the following best describes the change in the length of time required to reach an equilibrium count rate after insertion of a fixed amount of positive reactivity as a subcritical reactor approaches criticality? (1.0)

a. increases primarily because of the increased population of delayed neutrons in the core.

b. increases because of a larger number of neutron life cycles required to reach equilibrium.

c. decreases primarily because of the increased population of delayed neutrons in the core.

d. decreases because the source neutrons are becoming less important in relation to total neutron population.

QUESTION 5.21 (1.00)

Which of the following is correct? (1.0)

a. APLHGR = MAPLHGR / MAPRAT

b. MAPLHGR = MAPRAT / APLHGR

c. APLHGR = MAPLHGR * MAPRAT

d. MAPRAT = APLHGR * MAPLHGR

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

QUESTION 5.22 (1.00)

Which of the following conditions would tend to INCREASE the Critical Power level assuming all other variables remain unchanged? (1.0)

NOTE: ASSUME NORMAL FULL POWER OPERATING CONDITIONS

a. High pressure feedwater heating is lost

b. Turbine control failure causing control valves to close

c. The axial power peak is RAISED

d. Recirc pump speed reduction using the master controller

QUESTION 5.23 (1.00)

Which of the following statements is NOT true regarding the LHGR (linear heat generation rate) thermal limit? (1.0)

a. The LHGR design limit = 13.4 kw/ft for both 8x8 and P8x8R fuel.

b. The limit is based on maintaining peak cladding temperature </= 2200 degrees F.

c. The LHGR specification assures that the LHGR in any rod is less than the design value even if fuel pellet densification is postulated.

d. If the limit is exceeded, it could result in fuel clad cracking due to high stress.

QUESTION 5.24 (1.00)

Which of the following operations will REDUCE the AVAILABLE Net Positive Suction Head (NPSH) of an operating centrifugal pump? (1.0)

a. Throttling open the pump's suction valve.

b. Throttling open the pump's discharge valve.

c. Decreasing the pump's speed.

d. Decreasing the temperature of the fluid being pumped.

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

QUESTION 5.25 (1.00)

Which of the following best describes the change in system flow in a closed loop system with two identical constant speed centrifugal pumps in parallel, when changing from two to one pump operation (stopping the second pump)? (1.0)

a. Decreases by slightly less than half due to decreased flow resistance.

b. Decreases by slightly more than half due to increased flow resistance.

c. Decreases by half due to decreased discharge head.

d. Decreases by 1/4 due to decreased discharge head.

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

ANSWER 5.01 (1.00)

c.

REFERENCE
CNS Reactor Theory Ch. 6, Objective 2.5.2, p. 6-8

K/A 292006 K1.07 (3.2/3.2)
292006K107 ...(KA'S)

ANSWER 5.02 (1.00)

c

REFERENCE
CNS Reactor Theory Ch. 5, Objective 2.7, p. 5-14
292005K109 ...(KA'S)

ANSWER 5.03 (1.00)

c

REFERENCE
STEAM TABLES
CNS Heat Transfer and Fluid Flow, Ch. 3, Objective 1.2, p. 3-19
293001K101 ...(KA'S)

ANSWER 5.04 (1.00)

d

REFERENCE
Steam Tables
CNS Heat Transfer and Fluid Flow, Ch. 3, Objective 1.2, p. 3-15
293003K112 293003K123 ...(KA'S)

ANSWER 5.05 (1.00)

a

REFERENCE
CNS Mitigating Core Damage, Fission Product Source Terms
292006K101 ...(KA'S)

ANSWER 5.06 (1.00)

c. (1.0)

REFERENCE
CNS Teat Transfer and Fluid Flow, Ch. 7, Objective 6.4, p. 7-46
293007K111 ...(KA'S)

ANSWER 5.07 (1.00)

c

REFERENCE
CNS Reactor Theory, Ch. 7, Objective 3.5, p. 7-10
292008K111 ...(KA'S)

ANSWER 5.08 (1.00)

b

REFERENCE
CNS Reactor Theory, Ch. 4, Objective 3, p. 4-16
292004K110 ...(KA'S)

ANSWER 5.09 (1.00)

b

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 9, Objective 3.3, 3.4, p. 9-15
293009K108 ...(KA'S)

ANSWERS -- COOPER -88/07/19-PELLET, J.

ANSWER 5.10 (1.00)

d

REFERENCE
CNS Reactor Theory, Ch. 4, Objective 6.3, p. 4-34
292004K105 ...(KA'S)

ANSWER 5.11 (1.00)

c

REFERENCE
CNS Reactor Theory, Ch. 7, Objective 1.5, 1.7, 8.3, p. 7-5
292003K106 292003K107 ...(KA'S)

ANSWER 5.12 (1.00)

b

REFERENCE
CNS Reactor Theory, Ch. 1, Objective 6.1, p. 1-38
292002K111 ...(KA'S)

ANSWER 5.13 (1.00)

d

REFERENCE
CNS Reactor Theory, Ch. 1 Objective 5.1, p. 1-35
292002K110 ...(KA'S)

ANSWER 5.14 (1.00)

c

REFERENCE
CNS Reactor Theory, Ch. 5, Objective 2.5, p. 5-11
292006K114 ...(KA'S)

ANSWER 5.15 (1.00)

b

REFERENCE
CNS Reactor Theory, Ch. 3, Objective 3.5, p. 3-15
292003K105 ...(KA'S)

ANSWER 5.16 (1.00)

c

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 6, Objective 10.8, p. 6-75
293006K109 ...(KA'S)

ANSWER 5.17 (1.00)

a

REFERENCE
CNS Reactor Theory, Ch. 3, Objective 1.5, p. 3-8
201003K506 ...(KA'S)

ANSWER 5.18 (1.00)

d

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 8, Objective 2.7.b, p. 8-12
293008K109 ...(KA'S)

ANSWER 5.19 (1.00)

a

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 8, Objective 9.3, p. 8-45
293008K131 ...(KA'S)

ANSWER 5.20 (1.00)

b

REFERENCE
CNS Reactor Theory, Ch. 3, Objective 1.3, p. 3-9
292003K101 ...(KA'S)

ANSWER 5.21 (1.00)

c (MAPRAT = APLHGR/MAPLHGR)

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 9, Objective 4.5, p. 9-24
293009K114 ...(KA'S)

ANSWER 5.22 (1.00)

a

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 9, Objective 5.7, p. 9-25
293009K121 293009K122 293009K123 293009K124 293009K126
...(KA'S)

ANSWER 5.23 (1.00)

b

REFERENCE
CNS Heat Transfer and Fluid Flow, Objective 3.2-4, p. 9-16
293009K107 ...(KA'S)

ANSWER 5.24 (1.00)

b

REFERENCE
CNS Heat Transfer and Fluid Flow, Ch. 6, Objective 10.9-10, 6-77
291004K114 ...(KA'S)

ANSWER 5.25 (1.00)

a

REFERENCE
CNS Heat Transfer and Fluid FLow, Ch. 6, Objective 10.18, p. 6-100
293006K113 ...(KA'S)

QUESTION	VALUE	REFERENCE
05.01	1.00	JJP0002737
05.02	1.00	JJP0002738
05.03	1.00	JJP0002739
05.04	1.00	JJP0002740
05.05	1.00	JJP0002741
05.06	1.00	JJP0002742
05.07	1.00	JJP0002743
05.08	1.00	JJP0002744
05.09	1.00	JJP0002745
05.10	1.00	JJP0002746
05.11	1.00	JJP0002747
05.12	1.00	JJP0002748
05.13	1.00	JJP0002749
05.14	1.00	JJP0002750
05.15	1.00	JJP0002751
05.16	1.00	JJP0002752
05.17	1.00	JJP0002753
05.18	1.00	JJP0002754
05.19	1.00	JJP0002755
05.20	1.00	JJP0002757
05.21	1.00	JJP0002758
05.22	1.00	JJP0002759
05.23	1.00	JJP0002760
05.24	1.00	JJP0002761
05.25	1.00	JJP0002762
	25.00	
	25.00	

DOCKET NO 298