Examination Report No.: 50-206/OL-87-03

Facility: SONGS Unit 1

Docket No.: 50-206

Examination administered at SONGS Unit 1, San Clemente, California.

Chief Examiner: _____ 12/23/87
Gary W. Johnston, Date Signed
Operator Licensing Examiner

Approved: _____ 12/23/87
John O. Ellin, Chief Date Signed
Operations Section

Summary:

Examinations on December 14, 1987 (Report No. 50-206/OL-87-03)

A written examination was administered to a Reactor Operator candidate. He passed the examination, the oral portion was waived due to a prior passing evaluation.

REPORT DETAILS

1. Examiner:

   G. Johnston, RV (Chief Examiner)

2. Persons Attending the Exit Meeting:

   G. Johnston, RVC
   M. Kirby, SCE

3. Written Examination and Facility Review:

   The written examination was administered to the candidate on December 14, 1987.

   At the conclusion of the written exam, Mr. Kirby was given copies of the written exam for review. The comments were to be provided to the examiner in Region V no later than 5 working days from the date of the examination. The examiner had not recieved them on Tuesday, December 22, 1987. The examination was graded to the key without comments being resolved.

   The facility is advised that timeliness in providing comments is vital in assuring that the examination process proceeds in accordance with the Examiner Standards. For fairness and consideration of the candidate the examiner proceeded to grade the examination following the last mail delivery on December 22, 1987.

4. Exit Meeting

   The Chief Examiner met with the facility representative denoted in Paragraph 2 on December 14, 1987. The examiner discussed the findings to that point and the examination process.

U.S. Nuclear Regulatory Commission
Reactor Operator License Examination

Exam Key

Facility: SONGS 1
Reactor Type: WESTINGHOUSE
Date Administered: DECEMBER 14, 1987
Examiner: GARY JOHNSTON
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
25.0	100.0	_____	_____	4. Procedures - Normal, Abnormal, Emergency, and Radiological Control
25.0		_____		TOTALS
		Final Grade	_____ %	

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

_____
Candidate's Signature

REQUIREMENTS FOR ADMINISTRATION OF WRITTEN EXAMINATIONS

1. A single room shall be provided for completing the written examination. The location of this room and supporting restroom facilities shall be such as to prevent contact with all other facility and/or contractor personnel during the duration of the written examination. If necessary, the facility should make arrangements for the use of a suitable room at a local school, motel, or other building. Obtaining this room is the responsibility of the licensee.

2. Minimum spacing is required to ensure examination integrity as determined by the chief examiner. Minimum spacing should be one candidate per table, with a 3-ft space between tables. No wall charts, models, and/or other training materials shall be present in the examination room.

3. Suitable arrangements shall be made by the facility if the candidates are to have lunch, coffee, or other refreshments. These arrangements shall comply with Item 1 above. These arrangements shall be reviewed by the examiner and/or proctor.

4. The facility staff shall be provided a copy of the written examination and answer key after the last candidate has completed and handed in his written examination. The facility staff shall then have five working days to provide formal written comments with supporting documentation on the examination and answer key to the chief examiner or to the regional office section chief.

5. The facility licensee shall provide pads of 8-1/2 by 11 in. lined paper in unopened packages for each candidate's use in completing the examination. The examiner shall distribute these pads to the candidates. All reference material needed to complete the examination shall be furnished by the examiner. Candidates can bring pens, pencils, calculators, or slide rules into the examination room, and no other equipment or reference material shall be allowed.

6. Only black ink or dark pencils should be used for writing answers to questions.

NRC RULES AND GUIDELINES FOR LICENSE EXAMINATIONS

During the administration of this examination the following rules apply:

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

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

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

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

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

6. Use only the paper provided for answers.

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

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

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

10. Skip at least three lines between each answer.

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

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

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

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

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

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

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

18. When you complete your examination, you shall:

    a. Assemble your examination as follows:

        (1) Exam questions on top.

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

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

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

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

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

EQUATION SHEET

$f = ma$

$w = mg$

$E = mC^2$

$KE = \frac{1}{2}mv^2$

$PE = mgh$

$W = v\Delta P$

$\Delta E = 931\Delta m$

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

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

$Pwr = W_f \dot{m}$

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

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

$SUR = 26.06/T$

$T = 1.44\ DT$

$SUR = 26\left(\frac{\lambda_{eff}\rho}{\bar{\beta} - \rho}\right)$

$T = \left(\ell^*/\rho\right) + \left[(\bar{\beta} - \rho)/\lambda_{eff}\rho\right]$

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

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

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

$\rho = \left[\ell^*/TK_{eff}\right] + \left[\bar{\beta}/(1 + \lambda_{eff}T)\right]$

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

$\Sigma = N\sigma$

$v = s/t$

$s = v_o t + \frac{1}{2}at^2$

$a = (v_f - v_o)/t$

$v_f = v_o + at$

$\omega = \theta/t$

Cycle efficiency = $\frac{\text{Net Work (out)}}{\text{Energy (in)}}$

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

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

$t_{\frac{1}{2}}(eff) = \frac{(t_{\frac{1}{2}})(t_b)}{(t_{\frac{1}{2}} + t_b)}$

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

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

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

$TVL = 1.3/\mu$

$HVL = 0.693/\mu$

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

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

$CR_1(1 - K_{eff})_1 = CR_2(1 - K_{eff})_2$

$M = 1/(1 - K_{eff}) = CR_1/CR_0$

$M = (1 - K_{eff})_0/(1 - K_{eff})_1$

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

$\ell^* = 1 \times 10^{-5}$ seconds

$\lambda_{eff} = 0.1\ \text{seconds}^{-1}$

$I_1 d_1 = I_2 d_2$

$I_1 d_1^2 = I_2 d_2^2$

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

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

WATER PARAMETERS

1 gal. = 8.345 lbm

1 gal. = 3.78 liters

1 ft^3 = 7.48 gal.

Density = 62.4 lbm/ft^3

Density = 1 gm/cm^3

Heat of vaporization = 970 Btu/lbm

Heat of fusion = 144 Btu/lbm

1 Atm = 14.7 psi = 29.9 in. Hg

1 ft. H_2O = 0.4335 lbf/in^2

MISCELLANEOUS CONVERSIONS

1 Curie = 3.7×10^{10} dps

1 kg = 2.21 lbm

1 hp = 2.54×10^3 BTU/hr

1 Mw = 3.41×10^6 Btu/hr

1 Btu = 778 ft-lbf

1 inch = 2.54 cm

$^\circ F = 9/5\,^\circ C + 32$

$^\circ C = 5/9\ (^\circ F - 32)$

SECTION FOUR

PROCEDURES --
NORMAL, ABNORMAL, EMERGENCY
AND
RADIOLOGICAL CONTROL

QUESTION 4.01

SO123-O-3 "Control Operator's Responsibilities and Duties":

a. To whom is the control operator directly responsible to? (0.5)

b. What is the control operator's responsibility if he determines the safety of the unit is in jeopardy ? (0.5)

*ANSWER

a. The SRO Operations Supervisor. (0.5)

b. To shutdown the reactor. (0.5)

*REFERENCE: SO123-O-3 Pgs 3, 4, 6.

QUESTION 4.02

SO123-O-10 "Operations Shift Relief" describes the requirements for operations shift relief and turnover.

a. What are the three (3) items that as a minimum must be completed for shift turnover? (1.5)

b. When can the shift turnover proceed if a transient or plant upset condition is occuring? (0.5)

*ANSWER

a. 1. Complete the shift relief status sheets, (0.5)
   2. Review the chronological logs (over the previous 48 hours or since the last time on shift in this position), (0.5)
   3. Inspect the control room for safety-related equipment / system operation. (0.5)

b. Until a logical break point has been reached or the transient is completed. (0.5)

*REFERENCE: SO123-O-10 Pgs 3, 8.

QUESTION 4.03

The plant is operating at 100% power when you notice the rods are full out and Tave is dropping. You determine that an inadvertant boration is occuring, and take the following actions immediately:

i. Verify closed or close (CV-334) boric acid transfer pumps supply to charging pumps.

ii. Verify closed or close (CV-1102B) boric acid injection pump flow control valve.

iii. Verify closed or close (CV-333) boric acid injection pumps recirculation valve.

What two other immediate operator actions must be taken if an unplanned boration occurs ? (2.0)

*ANSWER

Stop all boric acid transfer and injection pumps. (1.0)

Verify closed or close (CV-1100B and CV-1100D) RWST supply to charging pumps. (1.0)

*REFERENCE 501-2.1-4 Pg 2.

QUESTION 4.04

SOI-2.1-9 "Loss of Residual Heat Removal System" specifies the actions to be taken to establish a primary system feed and bleed decay heat removal capability.

a. If the Component Cooling Water system is not availiable, why must charging flow be kept to greater than 60 gpm? (1.0)

b. When must consideration be given to diverting the bleed flow to the containment? (1.0)

*ANSWER

a. To ensure pump cooling due to loss of miniflow cooling. (1.0)

b. When the return to service of the RHR or a S/G is doubtful for an extended period. (1.0)

*REFERENCE SOI-2.1-9 Pg 6.

QUESTION 4.05

During a reactor startup the reactor is at 10% of full power, an uncontrolled and continuous control rod withdrawal occurs when you initiate rod motion to raise reactor power.

What immediate operator actions must be taken if a continuous control rod withdrawal occurs in automatic mode ? (1.0)

*ANSWER

Transfer reactor control to manual and stabilize Tavg. (1.0)

*REFERENCE 301-2.3-1

QUESTION 4.06

During operation at 90% of full power a Pressurizer Low Pressure alarm occurs. You determine that the alarm appears valid.

What four immediate operator actions must you take ? (2.0)

*ANSWER

1. Verify energized or energize backup heaters, (0.5)
2. Verify closed or close pressurizer spray valves, (0.5)
3. Verify closed or close pressurizer relief valves, (0.5)
4. Verify closed pressurizer safety valves. (0.5)

*REFERENCE 501-2.3-3 Pg 5.

QUESTION 4.07

SO1-1.0-10 "Reactor Trip or Safety Injection" requires immediate actions after a Safety Injection to verify AFW flow and containment integrity.

a. What is the minimum discharge pressure of both AFW pumps to ensure adequate flow? (0.5)

b. What is the minimum total flow capability of AFW that must be attained to ensure adequate flow? (0.5)

c. Above what containment pressure must you ensure that Containment Spray has initiated? (0.5)

*ANSWER

a. Greater than 700 psig, (0.5)

b. Greater than 163 GPM, (0.5)

c. More than 10 psig. (0.5)

*REFERENCE SO1-1.0-10 Pgs 11, 13, 15.

QUESTION 4.08

10 CFR 20, Standards for Protection Against Radiation governs exposure of individuals to ionizing radiation.

a. What is the definition of a Radiation Area in accordance with 10 CFR 20? (1.0)

b. What is the definition of a High Radiation Area in accordance with 10 CFR 20? (0.5)

*ANSWER

a. Radiation Area - Area where the major part of the body could recieve:

5 mRem in 1 hour (0.5)

or 100 mRem in 5 days (0.5)

b. High Radiation Area - Area where the major part of the body could recieve:

100 mRem in 1 hour (0.5)

*REFERENCE

10 CFR 20

QUESTION 4.09

The first priority after you determine a steam generator tube rupture has occured is to identify the location of the tube rupture.

a. How is the ruptured steam generator identified **SIMPLY** for a large tube rupture? (0.5)

b. What two (2) other methods for identification are used if the ruptured steam generator is not immediately identifiable? (1.0)

c. Why must the affected steam generator be identified early when a steam generator tube rupture occurs? (1.0)

*ANSWER

a. Check SG narrow range level: An unexpected level rises in the ruptured SG. (0.5)

b. 1. Individual SG activity sampling. (0.5)
2. Individual SG blowdown activity monitoring. (0.5)

c. Minimize feed to the ruptured SG to prevent overfill. (1.0)

*REFERENCE SG1-1.0-40 Pgs 3, 67.

QUESTION 4.10

Emergency Operating Instruction SOI-1.3-1 "Response to Loss of Secondary Heat Sink" is in use following a loss of all feedwater to the steam generators, the Containment is normal.

a. What must be done if two (2) Steam Generator level indications are less than 30 inches on the wide range level indicators? (1.0)

b. What two (2) parameters determine a NORMAL Containment status? (1.0)

*ANSWER

a. Trip all operating RCP's and proceed to RCS feed and bleed. (1.0)

b. 1. <3 psig. (0.5)
2. <10E+3 R/hr. (0.5)

*REFERENCE SOI-1.3-1 Pgs 3, and 75.

QUESTION 4.11

What actions should you take as control operator if in your opinion an operating procedure is wrong in intent or in some specific detail for the existing plant condition? (1.5)

*ANSWER

1. Stop this procedure, (0.5)
2. Place the plant in a safe and stable condition, (0.5)
3. Inform the SRO operations supervisor. (0.5)

*REFERENCE SO123-O-20 Pgs 5, 6.

QUESTION 4.12

SO123-O-23 "Control of System Alignments" specifies the requirements for system alignment control.

Which personnel are allowed to perform or independently verify system alignments? (0.5)

*ANSWER

Only qualified operators. (0.5)

*REFERENCE SO123-O-23 Pgs 3, 4.

QUESTION 4.13

Health Physics Procedure SO123-VII-4 "Personnel Monitoring Program" specifies the limits for exposure to individuals working at SONGS.

What are the quarterly administrative limits in milli-Rem (mRem) for each of the following?

a. Whole body. (0.5)

b. Extremities (hands, forearms, feet and ankles). (0.5)

c. Skin of the whole body. (0.5)

*ANSWER

a. 900 mRem (0.5)

b. 4700 mRem (0.5) (Will accept 4.7 Rem)

c. 3750 mRem (0.5) (Will accept 3.75 Rem)

*REFERENCE
SO123-VII-4 pg 7.

QUESTION 4.14

Procedure SO1-3-5 "Plant Shutdown From Hot Standby to Cold Shutdown", specifies that when RCS pressure is 600 - 500 psig the SIS/Feedwater system must be re-aligned for Cold Shutdown operations. This provides two positive barriers between the RCS and the feedwater system.

Why must this re-alignment be done prior to reducing RCS pressure to less than 500 psig? (1.0)

*ANSWER

To prevent unborated water flow into the RCS before reducing pressure below 500 psig. (1.0)

*REFERENCE
SO1-3-5 pg 14.

QUESTION 4.15

Procedure SO1-3-2 "Plant Startup from Hot Standby to Minimum Load" cautions you to maintain Steam Generator level at approximately 50% when in manual level control and to be aware of plant conditions that would affect the level in the Steam Generators.

What concern may arise if there is a sudden decrease in Steam Generator level? (1.0)

*ANSWER

The potential exists to uncover the feedring in the Steam Generators. This could present a hazard of waterhammer in the Feed and condensate system. (1.0)

*REFERENCE
SO1-3-2 pg 9.

QUESTION 4.16

Technical Specification 4.1.1 requires a channel check on a once per shift basis of the Pressurizer pressure indication. During the conduct of a 12 hour surveillance you determine that the last surveillance channel check was done at 0600 hours this morning December 14. The surveillance performed prior to that time was at 1500 hours the evening of December 13.

When is the LATEST the NEXT surveillance will be due, if you perform the surveillance now (2000 hours)? (2.0)

*ANSWER

1500 to 0600 = 15 hours
0600 to 2000 = 14 hours

The next surveillance would be performed at:

3.25 X 12 = 39 hours per the T. S. from the 1500 surveillance on December 13. (1.0)

on 0600 December 15. (1.0)

*REFERENCE
Technical Specifications, 4.0.2

End of Examination

****