



Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35607

February 13, 1991

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

BROWNS FERRY NUCLEAR PLANT (BFN) - REACTOR OPERATOR AND SENIOR OPERATOR
LICENSING EXAMINATIONS

The purpose of this letter is to submit the enclosed TVA's comments on the written part of the reactor operator and senior operator licensing examinations as required by NUREG 1021-ES-201. The examinations were administered at BFN during the week of December 10, 1990. A copy of the enclosed written examination comments had previously been given to the lead examiner on December 13, 1990.

If you have any further questions, please get in touch with me at (205) 729-3570.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Patrick P. Carrier, Manager
of Site Licensing

Enclosures
cc: See page 2

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U.S. Nuclear Regulatory Commission

February 13, 1991

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ENCLOSURE

2695 Reactor Operator 002
QUESTION: 002 (1.00)

Given the following exposure history data for an individual:

Lifetime exposure: 19500 mrem (Form 4 on file).
Annual exposure: 4300 mrem.
Quarterly exposure: 600 mrem.
Age: 22.
Sex: Male.

SELECT the ONE statement below that describes the MAXIMUM ADDITIONAL whole body exposure the individual is allowed in the current calendar quarter under FEDERAL (10 CFR 20) exposure limits.

- a. 400 mrem.
- b. 500 mrem.
- c. 650 mrem.
- d. 700 mrem.

COMMENTS:

Browns Ferry Radiological Control Instruction RCI-1 page 9 (attached) step 6.2.2.2.2. Limit BFN employee's to 5 (N 18) and is based upon the limits in the CODE OF FEDERAL REGULATIONS 10 CFR 20.101(b)(2). Therefore under RCI-1 plant specific and the 10 CFR 20.101(b)(2) 5 (N 18) will not be exceeded.

RESOLUTION:

Change the answer key to reflect B (500 mrem) as the correct response to the question.

6.2 Exposure Control (Continued)

6.2.2 Occupational Radiation Exposure Limits

6.2.2.1 Limits

With Written Signed Dose Estimate for Current Calendar Quarter (QTR)

Age	Quarterly Limits			Annual Limits ^c Whole Body (rem)	Lifetime ⁸ Whole Body (rem)
	Whole Body ^a (rem)	Skin ^a (rem)	Extremities ^d (rem)		
18	1.000 ^f	7.500	18.750	1.000 ^e	1N
≥19	1.000 ^d	7.500	18.750	1.000 ^e	1N

^a The whole body extends from the top of the head down the arms to just above the elbows, and down the legs to the ankle. Skin refers to the skin of the whole body which excludes the skin of the extremities. Extremities extend from just above the elbow to the finger tips, and just above the ankle to the tip of the toes.

^b N = Age in years at last birthday.

^c Dose extensions in excess of this guideline must be authorized in writing by the Senior Vice President of Nuclear Power or his designee. Each instance in which a worker exceeds the 5 rem administrative limit (and the reasons) will be promptly reported to the NCO RADCON manager and the Senior Vice President of Nuclear Power.

^d 3.000 rem with a complete Form 4 or equivalent (e.g., form TVA 17086)

^e 5.000 rem with a complete form 4 or equivalent (e.g., form TVA 17086)

^f 1.250 rem with a complete Form 4 or equivalent (e.g., form TVA 17086)

⁸ Individuals whose lifetime accumulated dose is equal to or exceeds 1N rem shall be limited to 1000 mrem per year.

6.2.2.2 General Requirements

6.2.2.2.1 Individuals under the age of 18 are not permitted to enter any radiologically controlled area.

6.2.2.2.2 Any worker who exceeds a regulatory dose limit for any monitoring period shall not be permitted to enter any radiologically controlled area for the remainder of that period. In addition, that same worker shall not exceed 1.25 rem in any subsequent quarter unless permitted in accordance with the 1N dose average. In no case will an individual be allowed to exceed the 5(N/18) dose averaging requirement described in 10 CFR 20.10(b)(2).

NOTE: In exceptional circumstances, the site director may request an individual be authorized to exceed 1N REM IN A LIFETIME. Written approval from the Senior Vice President or his site designees must be obtained.

QUESTION: 008 11941 Senior Reactor Operator
(1.00)

Given the following work schedule for a control room operator on Unit 2 during a refueling outage:

Thursday	- Did not work	Sunday	6 am to 6 pm
Friday	- Did not work	Monday	6 am to 2 pm
Saturday	- 6 am to 2 pm	Tuesday	6 am to 8 pm

SELECT the ONE schedule below that would require the permission of the Operations Superintendent for the operator to work the remaining week.

- a. Wednesday - 6 am to 2 pm.
 Thursday - 6 am to 10 pm.
 Friday - 6 am to 2 pm.
- b. Wednesday - 6 am to 8 pm.
 Thursday - 6 am to 4 pm.
 Friday - Does not work.
- c. Wednesday - 6 am to 2 pm.
 Thursday - 6 am to 8 pm.
 Friday - 6 am to 4 pm.
- d. Wednesday - 6 am to 2 pm.
 Thursday - 6 am to 10 pm.
 Friday - Does not work.

COMMENTS:

There are three correct responses to the question as asked. PMI 12.12 section 4.5 (attached) limit the number of hours worked in a 48 hour period to less than 24, selection B. The number of hours worked in any seven day period is also limited to 72 hours which selection A and C exceed. Therefore as asked the Question has 3 correct choices A, B or C.

RESOLUTION:

For future exams, change the question to elicit the schedule that would NOT require the permission of the Operations Superintendent for the Operator to work the remaining week.

For the exam administered at BFN on 12/10/90 we request this question be removed from the examination.

4.5 Staffing and Station Operating Complement (Continued)

- 4.5.10 One operator shall man the Radwaste Building at all times. This is required because the "Radwaste Abnormal" alarm in Unit 1 control room no longer exists.
- 4.5.11 The Shift Operations Supervisor shall determine the alertness and attentiveness of all operators assigned to safety-related duties. If, in the opinion of the Shift Operations Supervisor, an operator does not possess these capabilities, he shall be relieved or reassigned to non-safety-related functions. It is the responsibility of the person being relieved to ensure that the person assuming his/her position is mentally and physically alert. In order to reduce the potential for operator error due to fatigue, it is the plant's policy not to assign operators to shift duties while in a fatigued condition that could significantly reduce their mental alertness or affect their decision-making capabilities.

[NRC/C] Every effort shall be employed to ensure that a sufficient number of operating personnel remain available to maintain adequate shift coverage without routine reliance on excessive overtime. The objective, therefore, is to have personnel work an eight-hour day, forty-hour week under routine operating conditions. However, in the event that overtime becomes necessary, the following guidelines will be followed:

- 4.5.11.1 An individual should not be permitted to work more than 16 hours straight (excluding shift turnover time).
- 4.5.11.2 An individual should not be permitted to work more than 16 hours in any 24-hour period, nor more than 24 hours in any 48-hour period, nor more than 72 hours in any seven-day period (all excluding shift turnover time).
- 4.5.11.3 A break of at least (8) hours should be allowed between work periods (including shift turnover time).

4.5 Staffing and Station Operating Complement (Continued)

- 4.5.11.4 Except during extended shutdown periods, the use of overtime should be considered on an individual basis, and not for the entire staff on shift.
- 4.5.11.5 If unusual circumstances arise that require deviation from the above guidelines, such changes shall be authorized by the Plant Manager, Plant Operations Manager, Operations Superintendent, or higher levels of management. The SOS shall indicate in his log when any Operations shift personnel exceed the above guidelines and the circumstances that prevailed. [NRC Generic Letter No. 82-12]
- 4.5.12 A weekly schedule for Operations personnel will be issued from the Operations Superintendent's Office. This weekly schedule will normally assign the same SRO/ASOS and lead operator each week from each group to Unit 2. The BOP Operator for Unit 2 will be rotated by this schedule every group rotation for purposes of license maintenance and keeping individuals "fresh" on a near-term operating unit. Assistant Unit Operators will be rotated on this schedule to maintain qualifications and ensure personnel become experienced on the near-term operating unit. The Shift Operations Supervisor will make control room operator assignments at the beginning of each shift to implement this weekly schedule, to be in effect for the scheduled period, i.e., 2230-0630, 0630-1930, 1430-2230 shift period. The control room assignments will be as follows:
- 4.5.12.1 One unit operator will be designated as the lead operator for the shift for each unit.
- 4.5.12.2 Other unit operators will be assigned as necessary when specified by the Operations Superintendent. Normally one extra unit operator, as a minimum, will be assigned to Unit 2.

NOTE:

Section 5.0 delineates responsibilities. Section 5.7 differentiates between LEAD and BOP Unit Operators.

QUESTION: 038 (1.00)

Given the following plant conditions:

The Reactor Core Isolation Cooling (RCIC) and High Pressure Coolant Injection (HPCI) systems are operating in CST to CST recirculation mode in accordance with EOI appendix 11.

Reactor water level is being maintained by condensate booster pumps at +30 inches

SELECT the ONE statement that describes the effect on the RCIC system if the HPCI pump suction automatically swaps to the suppression pool source.

- a. A no-flow condition will exist and the RCIC pump is in danger of overheating.
- b. The RCIC Pump Minimum Flow Valve (FCV 71-34) will open when flow decreases to less than 60 gpm.
- c. RCIC will trip on low pump suction pressure when the RCIC CST suction valve closes.
- d. RCIC will trip on high pump discharge pressure due to a no-flow condition existing.

COMMENTS:

Emergency Operating Instruction Appendix 11 provides guidance for placing HPCI and RCIC in CST to CST recirculation for RPV pressure control. Guidance is provided with an automatic initiation signal present or a manual initiation. The stem of the question does not provide evidence of manual or automatic initiation. The minimum flow valve will open when a low discharge flow condition is sensed, if an automatic initiation signal is present. Therefore item A is correct if a manual initiation is assumed or item B is correct if an automatic initiation is assumed. The unit conditions established in the stem of the question indicate an EOI-1 entry condition was met i.e. execution of Appendix 11 and the Reactor pressure has decreased to a value low enough for the low pressure system to maintain inventory.

RESOLUTION:

Change the answer key to accept A or B as correct responses.

QUESTION: 055 (1.00)

A reactor scram on Unit 2 results in the following plant conditions:

Reactor water level:	-10 inches.
Drywell pressure:	1.0 psig.
Ventilation radiation:	
Reactor building:	68 mr/hour.
Refueling zone:	35 mr/hour.

SELECT the ONE statement that describes the expected status of the control room ventilation.

- The normal ventilation system is operating. The emergency system is supplying filtered air from the control bay.
- The normal ventilation system is supplying air to the control room from the control bay.
- The emergency ventilation system is operating supplying filtered outside air. The normal ventilation system is isolated.
- The normal ventilation system is supplying outside air to the emergency ventilation system for filtration.

COMMENT:

OPL171.067, Revision 3 (attache) more clearly describes the effect on Control Bay HVAC if reactor water level falls below 111 inches. O-701-31-1 (attached), although written for Control Bay High Radiation, also describes this situation.

Control Bay normal ventilation consists of Board Room (Normal) Supply Fans supplying fresh air to the Control Room Air Handling Units (AHUs), and in turn, the AHUs cooling a combination of this fresh air and recirculated air, and delivering this air to the control rooms. The question therefore describes a situation where (1) Board Room Supply Fans (normal) are still running, supplying air to other control bay areas, (2) fresh air to the AHUs from the Board Room Supply Fans has been isolated, (3) Control Room Emergency Ventilation (CREV) is operating with suction from the Board Room Supply Fans.

- Therefore:
- could be considered correct if, the candidate assumes that "Normal Ventilation System" means the AHUs, and "from the control bay" means recirculated air.
 - could be considered incorrect if the candidate assumes that "Normal Ventilation System is isolated" means either (1) the entire board room supply fan is isolated, or (2) the AHU is isolated. The only path is isolated is normal fresh air to the AHU.
 - could be considered correct in that the "Normal Ventilation System" can be considered to be the Board Room Supply Fan, which indeed is "supplying outside air" to CREV for filtration.

RESOLUTION:

Delete question.

INSTRUCTOR NOTES

- (2) Local start at local control station

NOTE: Dampers do not operate automatically if started from local panel (FCV 31 150 B, D, I, F, and G close on Auto start or start from 9-25)

- (3) Automatic start signals

Obj. V.B.17.

- (a) High radiation of 270 cpm above background in air inlet ducts to control room

i. Radiation monitor RI 90 259A Units 1 & 2

ii. Radiation monitor RI 90 259B Unit 3

NOTE: Either monitor starts both CREV units.

- (b) Reactor zone ventilation systems radiation high >12 MR/hr

- (c) Refuel zone ventilation systems radiation high >67 MR/hr

- (d) Low reactor water level at 11 inches above instrument 0

- (e) High primary containment pressure >2.45 psig

- (4) On receipt of a start signal, outside airpaths to elevation 3C are isolated. Both CREV units start and their suction dampers open to supply pressurizing air to the Unit 1, 2 and 3 control rooms. One CREV unit can supply all three control rooms, so the

Obj. V.B.18.

INSTRUCTOR NOTES

- extra CREV unit can be manually secured if desired. Once started, the CREV units will continue to run until manually secured.
- (5) Control bay (II 617) isolation is accomplished by six pneumatic motor-operated, low leakage dampers which isolate all air intakes and exhausts for II 617.
- (a) FCV 31-150B, mounted in fresh air make up duct to Units 1 and 2 control room air conditioning system located in II 617 mechanical equipment room.
 - (b) FCO 31-150G, 3C elevation relief vent isolation
 - (c) FCV 31-150H, mounted in exhaust duct from Unit 1 toilet, locker, and other miscellaneous rooms at elevation 617; damper is located above control room ceiling near R11 and P lines.
 - (d) FCV 31-150D, mounted in fresh air makeup duct to Unit 3 control room air conditioning system and located in II 617 Mechanical Equipment Room
 - (e) FCV-31-150C, mounted in duct behind exhaust air grille for II 617 Unit 3 Mechanical Equipment Room
 - (f) FCV 31-150F, mounted in exhaust duct from unit 3 toilet, locker, and other miscellaneous rooms at elevation 617; damper is located above control room ceiling near R1B and N lines.

Note: Print shows this duct as blanked off.

1.0 PURPOSE

This abnormal operating instruction provides symptoms, automatic action and operator action for outside air contamination.

2.0 SYMPTOMS

2.1 The following annunciators in alarm:

2.1.1 Annunciator CONTROL ROOM HIGH RADIATION ISOLATION (I-XA-55-6B, Window 3), O-RA-90-259A or B on Unit 1 Panel 9-6, at 260 cpm greater than background.

2.1.2 Annunciator XA-31-151 CONT BAY EMERG PRESSURIZATION FANS A & B ON (I-XA-55-6B, Window 4), on Unit 1 Panel 9-6, (if both fans are running).

2.2 Various area radiation monitors (ARMs), air particulate monitors (APMs) and continuous air monitors (CAMs) may be in alarm.

2.3 A Group Six Isolation may have occurred.

3.0 AUTOMATIC ACTION

3.1 Control Bay Emergency Pressurization Fans will start and the following damper actions take place (no remote damper position indication provided):

System A

UNIT 1 EMERGENCY PRESSURIZATION SYS A, O-FCO-31-151, opens (located at Emergency Pressurization Fan A, Unit 1 Mechanical Equipment Room, EI 617)
AIR TO RELAY-CONTROL ROOM AHU, O-FCO-31-150B, closes (located above Relay Room AHU air inlet duct, Unit 1 Mechanical Equipment Room, EI 617)
UNIT 1 RET EXHAUST, O-FCO-31-150E, closes (located 4 ft west of janitor Door 612 in ceiling, SE corner, Unit 2 Control Room).

CONTROL ROOM RELIEF VENT ISOLATION DMP., O-DMP-31-150G, closes (located in ceiling above Unit 2 Operator's desk).

System B

UNIT 3 EMERGENCY PRESSURIZATION SYS B, O-FCO-31-152, opens (located at Emergency Pressurization Fan B, Unit 3 Mechanical Equipment Room, EI 617)
AIR TO UNIT 3 CONTROL ROOM AHU, O-FCO-31-150D, closes (located above Control Room AHU air inlet duct, Unit 3 Mechanical Equipment Rm, EI 617)
UNIT 3 RET EXHAUST, O-FCO-31-150F, closes (located in ceiling above NW end of Panel 9-6, Unit 3 Control Room).

4.0 OPERATOR ACTION

4.1 Immediate Action

None

4.2 Subsequent Action

4.2.1 VERIFY the increased radiation level on FRESH AIR MAKEUP DUCT
UI & 2 (3) CONT RM RADIATION-GAS Radiation Recorder,
O-RR-90-259A(B), at the Unit 1(3) Mechanical Equipment Rooms on
Panel 25-230(166), El 617'.

4.2.2 At the fans, VERIFY emergency pressurization fans are running.

4.2.3 If a fan failed to start and it should have started, START the fan
at Unit 1 Control Room Panel 9-25.

NOTE:

The following step transfers to fans with HEPA suction filters to provide more
efficient particulate filtering of the outside air supply to the control bay.

4.2.4 PLACE the NORMAL-EMERGENCY OPERATION SWITCH, O-BS-31-77, on
Panel 25-165 to the 2 (emergency) position at Unit 1 Mechanical
Equipment Room, El 617'.

4.2.5 At Panel 25-165, Unit 1 Mechanical Equipment Room, VERIFY the
following:

Panel Left Section

Board Room Supply Fans 1A and 2A are not running

Panel Mid-Section

Spreading Room Exhaust Fan A is not running
Spreading Room Supply Fans 1 and 2 are not running

Panel Right Section

Board Room Emergency Supply Fans 1B and 3B are running
Spreading Room Exhaust Fan B is not running

QUESTION: 085 (1.00)

Given the following plant conditions on Unit 2:

Reactor pressure: 1000 psig.
Drywell pressure: 50 psig.

SELECT the statement that describes an approved method for emergency depressurization in accordance with 2 EOI 1.

- a. Open any two of the Safety Relief Valves (SRVs).
- b. Open any one Automatic Depressurization System (ADS) valves.
- c. Override the shutdown cooling suction isolation valves and blowdown to the suppression pool via RHR if less than four SRVs can be opened.
- d. Blowdown with the RWCU system to the condenser if less than three SRVs can be opened.

COMMENTS:

Given that emergency reactor depressurization is required, override C2 in section RC/P of EOI (rev 4) requires that C2 be entered from RC/P

Step C2-2.3 requires that if less than three SRVs are opened, depressurization be augmented by one or more of the systems on the facing page. RWCU in the blowdown mode is not listed as an additional system on the facing page of step C2-2.3 nor is it in the EPGs and it's use is not appropriate as an additional system to rapidly depressurize the reactor.

This system is listed in RC/P and the method to operate the system is presented in Appendix 11. However, since C2 is entered from RC/P this system is not presented as an available system to rapidly depressurize the reactor and item D should not be considered an appropriate answer to question 85.

RESOLUTION:

For this question there is no correct answer, delete this question from the exam.

QUESTION: 092 (1.00)

2-EOI-2, Primary Containment Control requires drywell spray be initiated provided that adequate core cooling is assured.

SELECT the ONE statement that describes a situation where an RHR pump can be diverted from core cooling to spray the drywell.

- | | | |
|----|------------------|---|
| a. | RPV water level: | - 212 inches, Post Accident Flooding Range. |
| | RHR SYS I: | One pump operable, 7000 gpm. |
| | RHR SYS II: | INOPERABLE. |
| | CS SYS I: | Two pumps, 6200 gpm. |
| | CS SYS II: | INOPERABLE. |
| b. | RPV water level: | -164 inches, Post Accident Flooding Range. |
| | RHR SYS I: | Both pumps, 14,000 gpm. |
| | RHR SYS II: | INOPERABLE |
| | CS SYS I: | One pump operable, 2400 gpm. |
| | CS SYS II: | One pump operable, 2000 gpm. |
| c. | RPV water level: | -201 inches, Post Accident Flooding Range. |
| | RHR SYS I: | Both Pumps, 14,000 gpm. |
| | RHR SYS II: | INOPERABLE. |
| | CS SYS I: | INOPERABLE. |
| | CS SYS II: | One pump operable, 3125 gpm |
| d. | RPV water level: | -154 inches, Post Accident Flooding Range. |
| | RHR SYS I: | INOPERABLE. |
| | RHR SYS II: | One pump operable, 8500 gpm. |
| | CS SYS I: | INOPERABLE. |
| | CS SYS II: | INOPERABLE. |

COMMENT:

Step C7-2 of EOI 1 requires that one core spray subsystem be operating and injecting to the reactor with one core spray subsystem taking suction from the pool with reactor pressure less than 130 psig and water level being maintained at or above -210 inches on the reactor fuel zone instruments. These conditions must be met for successful establishment of adequate core cooling utilizing spray cooling.

Choice "a" is not correct because water level is below -210 inches.

Choices "b" and "d" are the only other choices which have level above TAF, -168 inches. Choice "d" is not correct since only the RHR pump is available to maintain water level. Choice "b" is the best answer since level is above TAF and there is more than one RHR pump available. Choice "c" is incorrect since level is below TAF.

RESOLUTION:

Change the answer key to reflect B as the correct response to the question.

C7-- CORE COOLING WITHOUT LEVEL RESTORATION

C7-1 Open or check Open all six ADS valves.

C7-1.1 IF all ADS valves CANNOT be opened, THEN open other SRV's until six valves are open.

C7-2 Operate as many CS pumps as possible, taking suction from the suppression pool and injecting into the Rx.

C7-2.1 WHEN:

- At least one CS subsystem is operating with suction from the suppression pool
- AND
- Rx pressure is below 130 psig
- AND
- Rx water level is maintained at or above -210 in. on LI-3-52 and 62A,

THEN STOP injection into the Rx from sources external to primary containment.

C7-3 WHEN Rx water level is restored to greater than -150 in.,
THEN enter LEVEL CONTROL at step RC/L.

END OF C7