ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
Browns Ferry Nuclear Plant
P. O. Box 2000
Decatur, Alabama 35601

MAR 30 1988

RECEIVED

88 MAR 31 AM : 35

U.S. NRC RGN II
ATLANTA, GA.

Mr. Ken Brockman, Chief
Operator Licensing Section
U.S. Nuclear Regulatory Commission, Region II
101 Marietta Street, NW
Atlanta, Georgia 30323

Dear Mr. Brockman:

In accordance with the provisions of NUREG-1021, "Operator Licensing Examiner Standards," Standard ES-201, enclosed are comments by the Browns Ferry Operator Training Group staff concerning the written examinations administered at Browns Ferry Nuclear Plant, March 23, 1988.

The enclosed comments are offered with the intent of providing assistance to the NRC examiners in establishing the appropriateness of the examination questions. Also, the comments serve to clarify and expand the answers on the NRC answer key as supported by TVA reference material.

With respect to any questions deleted, NRC is requested to consider allowing the examinee full credit for these questions in light of the time, effort and concentration required of the examinee.

These comments are respectfully submitted, and it is hoped the enclosed comments and proposed resolutions afford the examinees every opportunity to successfully pass the examination based upon the knowledges and skills required to safely operate the facility.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Hugo Pomrehn

H. P. Pomrehn
Site Director, BFN

Enclosure

8809140021 880823
PDR ADOCK 05000259
Q PDR

PERIODIC NSS CORE PERFORMANCE LOG

L CATION	1	2	3	4	5	6	7	8	9	10	11	12
A IAL REL PWR	0.58	1.02	1.04	1.03	1.05	1.08	1.09	1.13	1.13	1.15	1.02	0.69
R GION REL PWR	0.89	1.10	0.89	1.07	1.15	1.07	0.89	1.10	0.89			
R NG REL PWR	1.07	1.14	1.17	1.16	1.28	1.22	1.02	0.52				
A RM CAF	0.98	0.99	0.94	0.98	0.94	0.96						

R GION	1	2	3	4	5	6	7	8	9
M LCPR	0.716	0.821	0.717	0.789	0.726	0.789	0.717	0.819	0.714
OC	21-14	35-14	39-14	11-34	35-32	49-28	21-48	25-48	41-46
LOW	0.1245	0.1195	0.1246	0.1222	0.1247	0.1222	0.1246	0.1197	0.1254
Kr	1.34	1.52	1.34	1.44	1.35	1.44	1.34	1.52	1.32
M LPD	0.643	0.723	0.644	0.694	0.645	0.694	0.644	0.725	0.643
OC	21-14- 5	35-14- 5	39-14- 5	11-34-16	25-36-16	49-28-16	21-48- 5	25-48- 5	39-48- 5
KFL	1.75	1.97	1.75	1.89	1.75	1.89	1.75	1.97	1.75
M PRAT	0.629	0.706	0.630	0.689	0.636	0.689	0.630	0.707	0.629
OC	21-14- 5	35-14- 5	39-14- 5	13-32-16	25-36-19	47-30-16	21-48- 5	25-48- 5	39-48- 5
KPS	1.58	1.77	1.59	1.71	1.59	1.71	1.59	1.77	1.58

CMWT	2943.
PCT PWR	89.4
GMWE	977.3
CMFCP	0.821
CMFLPD	0.725
CMAPR	0.707
CMPF	1.973
CAEQ	0.112
CAQA	0.129
CAVF	0.335
CAPD	43.558
CRD	0.002
CRSYM	2.
PR	1001.88
DPC-M	18.62
DPC-C	24.52
RWL	33.15
DHS	21.13
WFW	11.72
WD	35.62
WTSUB	105.31
WTHB	-1.00
WT	107.10
PCTWTR	104.5
WTFLAG	2.0
ITER	0.0
IREC	0.0
IEQL	0.0
IXYFLG	0.0

F ILED SENSORS 2

FAILED LPRM LIST

3209,D,2	3217,D,2	4817,D,5	5617,A,1
0825,B,2	2425,A,5	2425,B,5	2425,C,5
2425,D,5	3225,D,5	4825,A,1	1633,B,2
3233,B,1	4033,A,5	4033,B,1	4033,C,5
4033,D,5	5633,B,1	5633,C,1	5633,D,1
2441,B,2	2441,C,2	0849,A,5	0849,B,5
0849,C,5	0849,D,5	1649,B,1	2449,C,2
3249,D,2	4049,C,2	1657,B,5	1657,D,1

BASE CRIT CODE

2425,1 4033,1 0849,1

T E 12 MOST LIMITING BUNDLES

	FOR MFLCPR				FOR MFLPD				FOR MAPRAT			
M LCPR	LOC	MCPR	CPRLIM	MFLPD	LOC	MRPD	RPDLIM	MAPRAT	LOC	MAPLHGR	LIMLHGR
0.821	35-14	1.534	1.260	0.725	25-48- 5	9.71	13.40	0.707	25-48- 5	8.49	12.00
0.821	25-14	1.534	1.260	0.724	35-48- 5	9.71	13.40	0.707	35-48- 5	8.48	12.00
0.819	25-48	1.538	1.260	0.723	35-14- 5	9.69	13.40	0.706	35-14- 5	8.47	12.00
0.819	35-48	1.539	1.260	0.722	25-14- 5	9.68	13.40	0.705	25-14- 5	8.46	12.00
0.805	37-12	1.565	1.260	0.694	11-34-16	9.30	13.40	0.699	25-12- 8	7.03	10.06
0.805	23-50	1.565	1.260	0.694	49-28-16	9.30	13.40	0.697	35-12- 8	7.[illegible]	10.13
0.805	37-50	1.565	1.260	0.694	11-28-16	9.29	13.40	0.696	35-50- 8	7.04	10.10
0.805	23-12	1.565	1.260	0.693	49-34-16	9.29	13.40	0.695	25-50- 8	7.07	10.18
0.790	29-14	1.595	1.260	0.687	13-32-16	9.20	13.40	0.689	13-32-16	8.27	12.00
0.789	31-14	1.596	1.260	0.687	47-30-16	9.20	13.40	0.689	47-30-16	8.27	12.00
0.789	11-34	1.596	1.260	0.686	13-30-16	9.19	13.40	0.688	13-30-16	8.26	12.00
0.789	31-48	1.597	1.260	0.686	47-32-16	9.19	13.40	0.688	47-32-16	8.26	12.00

T E NUMBER OF BUNDLES WITH MFLCPR GREATER THAN 1.0 = 0
T E NUMBER OF BUNDLES WITH MFLPD GREATER THAN 1.0 = 0
T E NUMBER OF BUNDLES WITH MAPRAT GREATER THAN 1.0 = 0

PERIODIC NSS CORE PERFORMANCE LOG

CONTROL ROD POSITIONS AND CALIBRATED LPRM READINGS

```
             ***48

59 D                                             30   46        ++   38   ++        ++   39   ++        ++   39   ++
   C                                             34                  43                  45                  43
   B                                             28                  43                  43                  41
55 A                                        ++   20   ++        ++   39   ++        ++   41   ++        ++   34   ++        ++

51                           32   ++        ++   43   ++        ++   49   ++        ++   50   ++        ++   45   46        ++   41   ++
                             37                  51                  64                  62                  55                  50
                             33                  56                  70                  67                  60                  52
47                      ++   27   ++        ++   62   ++        ++   78   46        ++   71   46        46   66   ++        ++   48   ++        ++

43            ++        ++   41   ++        ++   46   ++        ++   48   46        ++   49   ++        ++   47   ++        ++   45   ++        ++   37   ++
                             52                  54                  53                  55                  57                  54                  42
                             53                  56                  56                  59                  57                  58                  39
39            ++        ++   57   ++        ++   62   46        ++   55   ++        ++   59   ++        ++   59   ++        ++   66   ++        ++   33   ++

35            ++        ++   46   ++        ++   51   ++        ++   50   ++        ++   50   ++        ++   47   ++        ++   51   ++        ++   38   ++
                             58                  61                  59                  60                  56                  65                  44
                             58                  63                  60                  60                  42                  65                  43
31            ++        ++   65   ++        ++   56   ++        ++   61   ++        ++   49   ++        ++   57   ++        ++   68   ++        ++   41   ++

27            ++        ++   46   ++        ++   46   ++        ++   51   ++        ++   47   ++        ++   51   ++        ++   47   ++        ++   38   ++
                             60                  55                  62                  54                  59                  60                  44
                             59                  58                  61                  58                  59                  61                  44
23            ++        ++   67   ++        ++   66   ++        ++   58   ++        ++   60   ++        ++   55   ++        ++   69   ++        ++   40   ++

19            ++        ++   38   ++        ++   45   ++        ++   53   ++        ++   48   ++        ++   48   ++        ++   45   ++        ++   31   ++
                             47                  52                  62                  62                  57                  54                  34
                             47                  56                  65                  65                  59                  58                  27
15                      ++   43   ++        ++   66   ++        ++   72   ++        ++   67   ++        ++   66   ++        ++   60   ++        ++   21

11 D                              ++        ++   40   ++        ++   46   ++        ++   47   ++        ++   45   ++        ++   31   ++
   C                                             48                  54                  55                  53                  35
   B                                             50                  58                  60                  57                  32
07 A                                        ++   48   ++        ++   64   ++        ++   69   ++        ++   59   ++        ++   27

03                                                    ++        ++        ++        ++        ++        ++        ++

              02        06        10        14        18        22        26        30        34        38        42        46        50        54        58
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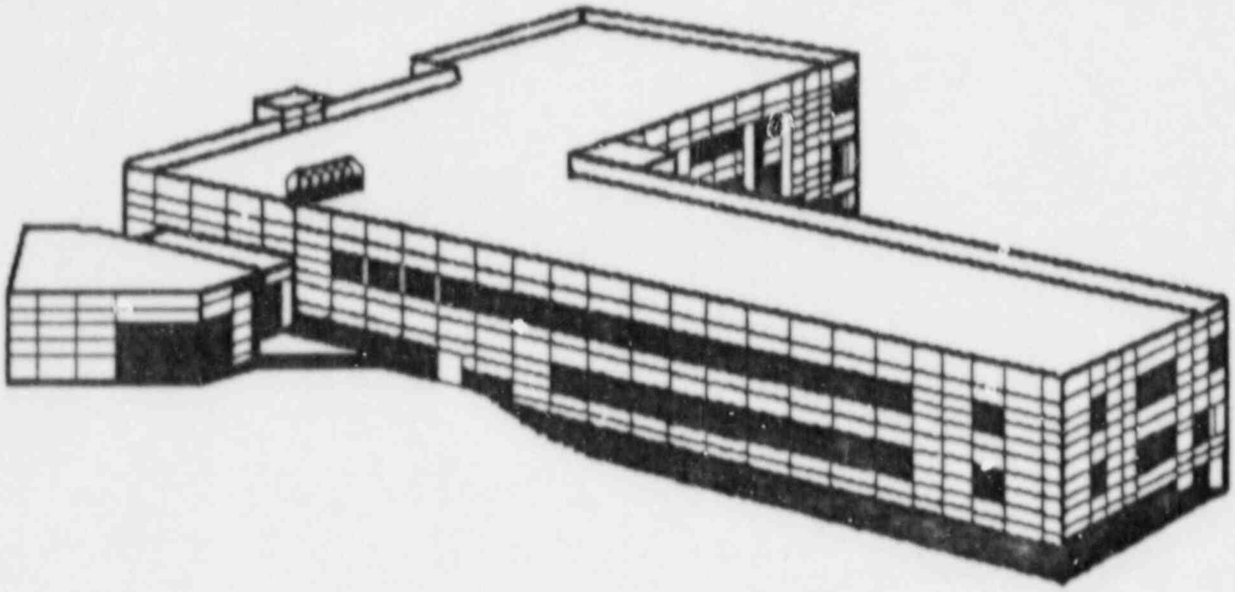
OPERATOR SUBS VAL CR LOC
NON-SYM ROD LOC FIRST QUAD 1803 1811 2215 2615 2619 1823

B.F.N.



T.V.A.

BROWNS FERRY TRAINING AND VISITOR CENTER

D TE 3-18-85 TIME 1444 BROWNS FERRY - 1 SEQ. NO. 7

PERIODIC NSS CORE PERFORMANCE LOG

LOCATION	1	2	3	4	5	6	7	8	9	10	11	12
AXIAL REL PWR	0.59	1.02	1.04	1.03	1.05	1.08	1.09	1.13	1.13	1.15	1.02	0.69
PERIPHERAL REL PWR	0.89	1.10	0.99	1.07	1.15	1.07	0.89	1.10	0.89			
RING REL PWR	1.07	1.14	1.17	1.16	1.28	1.22	1.02	0.52				
A R4 GAF	0.98	0.99	0.94	0.98	0.94	0.96						

	1	2	3	4	5	6	7	8	9
MFLCPR	0.716	0.821	0.717	0.789	0.726	0.789	0.717	0.819	0.714
LOC	21-14	35-14	39-14	11-34	35-32	49-28	21-48	25-48	41-46
LOW	0.1245	0.1195	0.1246	0.1222	0.1247	0.1222	0.1246	0.1197	0.1254
KF	1.34	1.52	1.34	1.44	1.35	1.44	1.34	1.52	1.32
MFLPD	0.643	0.723	0.644	0.694	0.645	0.694	0.644	0.725	0.643
LOC	21-14- 5	35-14- 5	39-14- 5	11-34-16	25-30-16	49-28-16	21-48- 5	25-48- 5	39-48- 5
KFL	1.75	1.97	1.75	1.89	1.75	1.89	1.75	1.97	1.75
MAPRAT	0.629	0.706	0.630	0.689	0.636	0.689	0.630	0.707	0.629
LOC	21-14- 5	35-14- 5	39-14- 5	13-32-16	25-30-19	47-30-16	21-48- 5	25-48- 5	39-48- 5
KFS	1.58	1.77	1.59	1.71	1.59	1.71	1.59	1.77	1.58

FAILED SENSORS 2

FAILED LPRM LIST

3209.D.2	3217.D.2	4317.D.5	5617.A.1
0025.B.2	2425.A.5	2425.B.5	2425.C.5
[illegible]25.D.5	3225.D.5	4025.A.1	1033.B.2
32[illegible].1	4033.A.5	4033.B.1	4033.C.5
4033.D.5	5633.B.1	5633.C.1	5633.D.1
2441.B.2	2441.C.2	0849.A.5	0849.B.5
0849.[illegible]	0849.D.5	1649.B.1	2449.C.2
3249.D.[illegible]	3249.C.2	1657.B.5	1657.D.1

BASE CRIT CODE

2425.1 4033.1 0849.1

CMWT	2943.
PCT PWR	89.4
GMWE	977.3
CMFCP	0.821
CMFLPD	0.725
CMAPR	0.707
CMPF	1.973
CAFQ	0.112
CAQA	0.129
CAVF	0.335
CAPD	43.558
CRD	0.002
CRSYM	2.
PR	1001.88
DPC-M	18.62
DPC-C	24.52
RWL	33.15
DHS	21.13
WFW	11.72
WD	35.62
WTSUB	105.31
WTHB	-1.00
WT	107.10
PCTWTR	104.5
WTFLAG	2.0
ITER	0.0
IREC	0.0
IEQL	0.0
IXYFLG	0.0

THE 12 MOST LIMITING BUNDLES

FOR MFLCPR				FOR MFLPD				FOR MAPRAT			
MFLCPR	LOC	MCPR	CPRLIM	MFLPD	LOC	MRPD	RPDLIM	MAPRAT	LOC	MAPLHGR	LIMLHGR
0.821	35-14	1.534	1.260	0.725	25-48- 5	9.71	13.40	0.707	25-48- 5	8.49	12.00
0.821	25-14	1.534	1.260	0.724	35-48- 5	9.71	13.40	0.707	35-48- 5	8.48	12.00
0.819	25-48	1.539	1.260	0.723	35-14- 5	9.69	13.40	0.706	35-14- 5	8.47	12.00
0.819	35-48	1.539	1.260	0.722	25-14- 5	9.68	13.40	0.705	25-14- 5	8.46	12.00
0.805	37-12	1.565	1.260	0.694	11-34-15	9.30	13.40	0.699	25-12- 8	7.03	10.06
0.805	23-50	1.565	1.260	0.694	47-28-16	9.30	13.40	0.697	35-12- 8	7.06	10.13
0.805	37-50	1.565	1.260	0.694	11-28-15	9.29	13.40	0.696	35-50- 8	7.04	10.10
0.805	23-12	1.565	1.260	0.693	47-34-15	9.29	13.40	0.695	25-50- 8	7.07	10.18
0.799	29-14	1.576	1.260	0.647	13-32-15	9.20	13.40	0.689	13-32-16	8.27	12.00
0.799	33-14	1.576	1.260	0.647	47-30-15	9.20	13.40	0.689	47-30-16	8.27	12.00
0.79[illegible]	11-34	1.575	1.260	0.646	13-30-16	9.19	13.40	0.688	13-30-16	8.26	12.00
0.79[illegible]	31-48	1.597	1.260	0.646	47-32-15	9.19	13.40	0.688	47-32-16	8.26	12.00

THE NUMBER OF BUNDLES WITH MFLCPR GREATER THAN 1.0 = 0
THE NUMBER OF BUNDLES WITH MFLPD GREATER THAN 1.0 = 0
THE NUMBER OF BUNDLES WITH MAPRAT GREATER THAN 1.0 = 0

```
3-16     3-13-85          TIME     1144              BROWNS FERRY - 1                         SEQ. NO.   7

                         ***PERIODIC NSS CORE PERFORMANCE LOG***

                      CONTROL ROD POSITIONS AND CALIBRATED LPRM READINGS

    ***48

59 D                   30 46  ++ 38 ++  ++ 39 ++  ++ 39 ++
   C                   34        43        45        43
   B                   28        43        43        41
55 A                ++ 20 ++  ++ 39 ++  ++ 41 ++  ++ 34 ++  ++

51             32 ++  ++ 43 ++  ++ 49 ++  ++ 50 ++  ++ 45 46  ++ 41 ++
               37        51        64        62        55        50
               33        50        70        67        60        52
47        ++ 27 ++  ++ 52 ++  ++ 76 46  ++ 71 46  46 66 ++  ++ 48 ++  ++

43    ++  ++ 41 ++  ++ 46 ++  ++ 48 46  ++ 49 ++  ++ 47 ++  ++ 45 ++  ++ 37 ++
             52        54        53        55        57        54        42
             53        56        56        59        57        58        39
39    ++  ++ 57 ++  ++ 62 46  ++ 55 ++  ++ 59 ++  ++ 59 ++  ++ 66 ++  ++ 33 ++

35    ++  ++ 46 ++  ++ 51 ++  ++ 50 ++  ++ 50 ++  ++ 47 ++  ++ 51 ++  ++ 38 ++
             58        51        59        60        56        65        44
             58        53        60        60        42        65        43
31    ++  ++ 65 ++  ++ 56 ++  ++ 51 ++  ++ 49 ++  ++ 57 ++  ++ 68 ++  ++ 41 ++

27    ++  ++ 46 ++  ++ 46 ++  ++ 51 ++  ++ 47 ++  ++ 51 ++  ++ 47 ++  ++ 38 ++
             60        55        52        54        59        63        44
             59        54        61        53        59        61        44
23    ++  ++ 67 ++  ++ 66 ++  ++ 58 ++  ++ 60 ++  ++ 55 ++  ++ 69 ++  ++ 40 ++

19    ++  ++ 38 ++  ++ 45 ++  ++ 53 ++  ++ 48 ++  ++ 43 ++  ++ 45 ++  ++ 31 ++
             47        52        62        62        57        54        34
             47        56        65        65        59        58        27
15        ++ 47 ++  ++ 66 ++  ++ 72 ++  ++ 67 ++  ++ 66 ++  ++ 60 ++  ++ 21

11 D            ++  ++ 40 ++  ++ 46 ++  ++ 47 ++  ++ 45 ++  ++ 31 ++
   C                   43        54        55        53        35
   B                   50        56        60        57        32
07 A                ++ 48 ++  ++ 64 ++  ++ 69 ++  ++ 59 ++  ++ 27

03                        ++  ++    ++  ++    ++  ++    ++

      02  06    10  14    18  22    26  30    34  38    42  46    50  54    58

OPERATOR SUBS VAL OR LOC
NON-STD ROD LOC FIRST QUAD  1003  1011  2215  2615  2619  1823
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Question 5.14 (3.00)

Question 1.02 (3.00)

LIST the three (3) "thermal limits" observed during reactor operation and STATE the limiting condition for each. (i.e., what the thermal limit is there to protect against.)

Answer:

1. LHGR - Linear HEat Generation Rate (.5)
   designed to limit the pin power at any node in the reactor to a value that limits the fuel clad strain to less than one percent plastic strain. (.5)

2. APLHGR - Average Planer Linear Heat Generation Rate (.5)
   (designed to limit average pin power at any node to a value such that following a design basis accident the) maximum fuel clad temperature will not exceed 2200°F. (.5)

3. MCPR - Minimum Critical Power Ratio (.5)
   (designed to limit the power of any fuel element to below the value that will) prevent any point in the bundle from experiencing the onset of transition boiling. (.5)

Reference:

BFNP: Heat Transfer and Fluid Flow, pp. 9-16 through 9-26.
Chapter 9, Objectives 2.3, 3.3, and 4.3.

TVA Comment:

The question does not elicit the detailed response of the answer key, specifically LHGR. The P-1 edit at BFN uses acronyms for these parameters and thses should be acceptable.
LHGR = MFLPD and CMFLPD
APLHGR = MAPRAT and CMAPR
MCPR - CMFCP and MFLCPR
(Reference chapter 9 and attached P-1 edit)

TVA Resolution:

Answer key should be changed to accept prevent >1% plastic strain vice. . . "pin power at any node" . . . Also key should reflect credit for acronym's if used for thermal limit designator.

1.04 (1.00)

5.02 (1.00)

Reactor power is 60 on IRM range 2 with the MINIMUM permissible stable positive period allowed by procedure GOI-100-1. Heating power is determined to be 40 on IRM range 7. CALCULATE how long it will take for power to reach the point of adding heat if the period remains constant.

Answer:

60 on range 2 is equal to 0.06 on range 7 (.25)

P(t) = P(0)e**-t/T (.25)

P(o) = 0.06, P(t) = 40, period = 60 seconds (.25)

t = 60 In 40.0.06 (.25)

= 390 seconds or 6.5 minutes (.25)

Reference:

BFNP: Reactor Theory, pp. 3-17 and 3-19
Chapter 3, Objective 3.2
GOI-100-1, p. 13

TVA Comment:

Answer key assumes that the reading on IRM range 7 is 40 on the 0-40 scale, and thus 40 on the range 8 (0-125 scale). But, heating range is normally reached mid range 7, so some may assume the question was giving POAH as 40/125 on range 7. This means that P(o) = .19/125 on range 7, instead of P(o) = .06/40 on range 7. Then, t = T ln (40/125 / .19/125) = 321 sec

Instead of t = T ln (40/40 / .06/40) = 390 sec.

"40/125" is a reasonable assumption also since 40/40 would result in full scale readings and scram trips. At BFNP, we commonly use the 0-125 scale on any range.

TVA Resolution:

Allow use of either 40/40 or 40/125
- Use 40/40 on Range 7 as POAH
  t = 390 sec
  or
- Use 40/125 on range 7 as POAH
  t = 321 sec.

1.04 (1.00)

5.02 (1.00)

TVA Comment:

Plant procedure GOI 100-1 does allow for reactor periods of < 60 seconds, but ≥ 30 seconds, although it is desirable to have a period of > 60 seconds. This question tests the application and understanding of Reactor Theory, therefore a candidate who elects to choose 60 seconds or 30 seconds as the minimum permissible period should receive credit. (REF GOI 100-1, p. 13)

TVA Resolution:

Expand the answer key to accept a response using 30 seconds as minimum period in addition to current answer key.

1749Q

Section III. Startup (Continued) INITIALS/TIME/DATE

A. Criticality (Continued)

****

CAUTION

DURING A HOT STARTUP FOLLOWING A REACTOR SCRAM AT HIGH POWER, THE CONDITIONS OF PEAK XENON WITH NO MODERATOR VOIDS COULD EXIST AT THE TIME OF STARTUP. UNDER THESE CONDITIONS, EXTREMELY HIGH ROD NOTCH WORTHS CAN BE ENCOUNTERED.

****

4. Upon approval of the shift engineer, start control rod withdrawal in accordance with OI-85. (R)____/ /____

NOTE: Shift all SRM and IRM recorders to fast speed prior to criticality and return to slow speed after initial period measurements are calculated.

NOTE: Within the approved control rod withdrawal sequence, it is possible to have a period less than 60 seconds. If a period less than 30 seconds is observed, insert rods until subcriticality is observed and contact the nuclear engineer and shift engineer before pulling any more rods. Periods less than 5 seconds are reportable to the NRC within 24 hours.

5. Observe the period meter when pulling rods and govern withdrawal rate to avoid having
* a period shorter than 60 seconds. (R)____/ /____

* NOTE: Reactor is critical when neutron flux rises on a constant (stable) period without further control rod movement.

6. When critical, record time, rod position, ~~rod notch~~, period, and reactor water temperature
* from recirculation loop A in daily journal. (R)____/ /____

NOTE: Measure period as follows:
For 10% power rise, multiply time of rise by 10.5.
For doubling time, multiply time of rise by 1.445.
For decade rise, divide time of rise by 2.3.

* For direct period measurement when on IRMs:
* a. Time 25 to 68 on black scale ranges
* b. Time 8 to 22 on red scale ranges

* Revision

5.16 (2.00)

1.16 (2.00)

Question:

The attached FIGURE (GTH-747 represents parameter changes for a plant transient on UNIT TWO. Use this figure and the following information to answer EACH of the questions below:

(1) Initial Power Level = 100%
(2) Bypass Valves go to Full Open position
(3) No operator action is taken

a. The DECREASE in turbine st- -low. (point 4)

b. The INCREASE in power. (point 7)

c. THe IN-REASE in turbine steam flow. (point 5 and AREA 6)

d. The DECREASE in pressure. (point 2)

Answer:

a. BPV's open causing EHC to close Turbine CV's. (.5)

b. Power increased due to lower feedwater temperature. (Less steam to the Turbine) (.5)

c. All BPV's are open at point 5. (.25) EHC follows increasing pressure by opening CV's. (.25)

d. Pressure decreases due to BPV's opening. (.5)

Reference:

BFNP: OPL171.055 LO a
4.1/4.2 3.6/3.7 4.1/4.1

TVA Comment:

Part C; Since the question stated that the BPV's were full open due to operation of the BPV jack, requiring this in the answer should not be required.

TVA Resolution:

Accept for full credit (.5), EHC follows increasing pressure by opening CV's.

1755Q

Question 2.02 (2.00)

Question 6.01 (2.00)

STATE whether the following statements concerning the Primary Containment Isolation System are TRUE or FALSE:

a. Most of the PCIS motor operated valves fail closed on loss of power to the valve.

b. The containment isolation reset switches on panel 9-5 must be operated to manually reset a RCIC turbine steam supply isolation.

c. Loss of RPS Bus A will NOT cause any PCIS isolation valves to close.

d. The TIP guide tube ball valve will isolate on a high radiation signal.

Answer:

a. False (MOV's fail as-is)
b. False (separate reset switch for RCIC)
c. True (both logic channels must deener.izo)
d. False (only high D/W pressure or low RPV level) (0.5 each)

Reference:

BFNP: OPL171.017, PCIS, pp. 6, 17 and 18
Objectives V.D and V.E.

TVA Comment:

Part C Answer key states True (both logic channels must de-energize). This is a true statement if RPS power is supplied to the respective logic channel. When the RPS bus power is lost, the relay loses potential even though the opposite PCIS channel relays have closed contacts.

OI-99 attachment 2 indicates valves that will isolate on RPS 'A' (inboard) or RPS 'B' (outboard) power loss.

TVA Resolution:

Answer key should be changed to reflect False as the correct response.

1752Q

RPS BUS A or B POWER TRANSFER

1. Transfer of power supply to either RPS Bus A or B may result in the following events:

VALVE	FUNCTION/SYSTEM	ACTION
FCV-32-62	Drywell Control Air Compressor suction	CLOSES
FCV-32-63	Drywell Control Air Compressor suction	CLOSES
FCV-64-17	Drywell/Suppression Chamber purge inlet	CLOSES
FCV-64-18	Drywell purge inlet inboard	CLOSES
FCV-64-19	Suppression Chamber purge inlet inboard	CLOSES
FCV-64-29	Drywell purge exhaust inboard	CLOSES
FCV-64-30	Drywell purge exhaust outboard	CLOSES
FCV-64-31	Drywell purge exhaust bypass to SGTS	CLOSES
FCV-64-32	Suppression Chamber purge exhaust inboard	CLOSES
FCV-64-33	Suppression Chamber purge exhaust outboard	CLOSES
FCV-64-34	Suppression Chamber purge exhaust bypass to SGTS	CLOSES
FCV-64-36	Drywell/Suppr Chbr purge exhaust to SGTS	CLOSES
FCV-64-139	Drywell to Suppr Chbr DP compressor suction	CLOSES
FCV-64-140	Drywell to Suppr Chbr DP compressor discharge	CLOSES
FCV-76-17	Drywell/Suppression Chamber nitrogen purge inlet	CLOSES
FCV-76-24	Drywell/Suppression Chamber nitrogen purge inlet	CLOSES
FCV-76-18	Drywell nitrogen purge inlet	CLOSES
FCV-76-19	Suppression Chamber nitrogen purge inlet	CLOSES
FCV-76-49	Containment Inerting System A sample	CLOSES
FCV-76-50	Containment Inerting System A sample	CLOSES

RPS BUS A or B POWER TRANSFER

1. Transfer of power supply to either RPS Bus A or B (Continued):

VALVE	FUNCTION/SYSTEM	ACTION
FCV-76-51	Containment Inerting System A sample	CLOSES
FCV-76-52	Containment Inerting System A sample	CLOSES
FCV-76-53	Containment Inerting System A sample	CLOSES
FCV-76-54	Containment Inerting System A sample	CLOSES
FCV-76-55	Containment Inerting System A sample	CLOSES
FCV-76-56	Containment Inerting System A sample	CLOSES
FCV-76-57	Containment Inerting System A sample	CLOSES
FCV-76-58	Containment Inerting System A sample	CLOSES
FCV-76-59	Containment Inerting System B sample	CLOSES
FCV-76-60	Containment Inerting System B sample	CLOSES
FCV-76-61	Containment Inerting System B sample	CLOSES
FCV-76-62	Containment Inerting System B sample	CLOSES
FCV-76-63	Containment Inerting System B sample	CLOSES
FCV-76-64	Containment Inerting System B sample	CLOSES
FCV-76-65	Containment Inerting System B sample	CLOSES
FCV-76-66	Containment Inerting System B sample	CLOSES
FCV-76-67	Containment Inerting System B sample	CLOSES
FCV-76-68	Containment Inerting System B sample	CLOSES
FCV-84-20	Drywell or Suppr Chbr exhaust to SGTS	CLOSES

RPS BUS A or B POWER TRANSFER

1. Transfer of power supply to either RPS Bus A or B (Continued):

VALVE	FUNCTION/SYSTEM	ACTION
FCV-90-254A	Drywell radiation monitoring sample	CLOSES
FCV-90-254B	Drywell radiation monitoring sample	CLOSES
FCV-90-255	Drywell radiation monitoring sample	CLOSES
FCV-90-257A	Drywell radiation monitoring sample	CLOSES
FCV-90-257B	Drywell radiation monitoring sample	CLOSES
FCO-64-13	Reactor Zone ventilation	CLOSES
FCO-64-14	Reactor Zone ventilation	CLOSES
FCO-64-40	Reactor Zone ventilation	CLOSES
FCO-64-41	Reactor Zone ventilation	CLOSES
FCO-64-42	Reactor Zone ventilation	CLOSES
FCO-64-43	Reactor Zone ventilation	CLOSES
FCO-64-5	Refuel Zone ventilation	CLOSES
FCO-64-6	Refuel Zone ventilation	CLOSES
FCO-64-9	Refuel Zone ventilation	CLOSES
FCO-64-10	Refuel Zone ventilation	CLOSES
FCO-64-44	Refuel Zone ventilation	OPENS
FCO-64-45	Refuel Zone ventilation	OPENS
	Reactor Zone supply and exhaust fans	TRIP
	Refuel Zone supply and exhaust fans	TRIP
	Standby Gas Treatment System	STARTS
	Control Bay Emergency Pressurization System A an B	STARTS
	Traversing Incore Probe System	AUTO RETRACT

RPS BUS A or B POWER TRANSFER

2. Transfer of power to RPS Bus A only may result in the following events in addition to those listed for RPS Bus A or B power transfer:

VALVE	FUNCTION/SYSTEM	ACTION
FCV-74-48	RHR shutdown cooling inboard suction	CLOSES
FCV-74-53	RHR System I inboard injection	CLOSES
FCV-74-102	RHR System HP flush/vent	CLOSES
FCV-74-103	RHR System LP flush/vent	CLOSES
FCV-75-57	Drain pump A inboard isolation	CLOSES
FCV-77-15A	Drywell equipment drain discharge	CLOSES
FCV-77-2A	Drywell floor drain discharge	CLOSES
FCV-69-1	RWCU inlet	CLOSES
FCV-69-2	RWCU inlet	CLOSES
FCV-69-12	RWCU outlet	CLOSES
FCV-1-14	MSIV AC control power	DE-ENERGIZES
FCV-1-26	MSIV AC control power	DE-ENERGIZES
FCV-1-37	MSIV AC control power	DE-ENERGIZES
FCV-1-51	MSIV AC control power	DE-ENERGIZES
FCV-1-55	Main Steam Line drain inboard	CLOSES
FCV-43-13	Recirc loop inboard sample	CLOSES

RPS BUS A or B POWER TRANSFER

3. Transfer of power to RPS Bus B only may result in the following events in addition to those listed for RPS Bus A or B power transfer:

VALVE	FUNCTION/SYSTEM	ACTION
FCV-74-47	RHR shutdown cooling outboard suction	CLOSES
FCV-74-67	RHR System II inboard injection	CLOSES
FCV-74-119	RHR System HP flush/vent	CLOSES
FCV-74-120	RHR System LP flush/vent	CLOSES
FCV-75-58	Drain pump A outboard isolation	CLOSES
FCV-77-15B	Drywell equipment drain discharge	CLOSES
FCV-77-2B	Drywell floor drain discharge	CLOSES
FCV-69-2	RWCU inlet	CLOSES
FCV-69-12	RWCU outlet	CLOSES
FCV-1-15	MSIV AC control power	DE-ENERGIZES
FCV-1-27	MSIV AC control power	DE-ENERGIZES
FCV-1-38	MSIV AC control power	DE-ENERGIZES
FCV-1-52	MSIV AC control power	DE-ENERGIZES
FCV-1-56	Main Steam Line drain outboard	CLOSES
FCV-43-14	Recirc loop outboard sample	CLOSES

LAST PAGE

IV. Abnormal Operations (Continued)

P. PRIMARY CONTAINMENT ISOLATIONS (1-8)

4. (Continued)

d. HPCI exhaust diaphragm pressure high (10 psig between rupture discs).

Refer to OI-73, Abnormal Section, for operator actions.

5. Group 5 - RCIC isolation is initiated by one or more of the following:

a. RCIC steamline space high temperature (200°).

b. RCIC steamline high flow (450" water ΔP or ≥ 150% after ~ 3-second time delay).

c. RCIC steamline low pressure (50 psig).

d. RCIC exhaust diaphragm pressure high (10 psig between rupture discs).

Refer to OI-71, Abnormal Section, for operator actions.

6. Group 6 - Ventilation systems isolation is initiated by one or more of the following:.

a. Reactor low level (+11 inches above instrument zero).

b. High drywell pressure (2.45 psig).

c. Reactor building high radiation (100 mr/hr).

Refer to OI-30, Abnormal Section, for operator actions.

1. Rx zone ventilation hi radiation 100mr/hr.
2. Refuel zone area hi radiation 100mr/hr.

7. Group 7 - Process line isolation is initiated by the following condition only.

a. The respective turbine steam supply valve not fully closed. Refer to OI-64, Abnormal Section, for operator actions.

8. Group 8 - TIP isolation is initiated by the following:

a. High drywell pressure at 2.45 psig.

* b. Reactor vessel low water level at + 11 inches above
* instrument zero. Refer to GOI-100-9, Abnormal Section, for operator actions.

*Revision

Question 2.05 (1.00)

Question 6.02 (1.00)

During your shift the Drywell Air System (DWAS) isolates. You verify a Group VI isolation has not occurred.

a. Name one other signal that could have caused the DWAS isolation.

b. WHAT air system valves close when the DWAG isolates? (i.e., valves within DWAS that will closes when the system gets an isolation signal).

Answer:

a. reactor zone ventialtion radiation signal (.5)
b. D/W air compressor suction valves (63,62) (.5)

Reference:

BFNP: OPL171.054, Control and Station Air Systems, p. 11.
Objectives V.C.

TVA Comment:

Part A: The control air lesson plan does make it appear, due to outline format, that Reactor zone high radiation is not a group VI isolation signal. The PCIS lesson plan 171.017 page 12 and OI 64, page 24 indicates it is a group 6 PCIS isolation. The candidates know the isolation signals and this question confused them. The format of OPL171.054 is being corrected. The loss of control air on U1 & U2 will result in closure of the valves 62 & 63. (REF OI 32A, Section 3.0)

TVA Resolution:

Part A: This question caused a great deal of confusion. The question should be deleted with credit for the time spent addressing the response since this was a timed examination.

Table 1
(continued)

Initiation Signals	Group 5	Valve Type	Location Ref. to Drywell	Power to Open (3)	Power to Close (4)
RCIC space hi temp. 200°F	RCIC turbine steam supply isolation valve (FCV 71-2)	MO Gate	Inside	AC	AC
RCIC steamline hi flow 150% (after a 3 second delay) RCIC steamline low press. 50 psig RCIC high pressure between rupture disc 10 psig	RCIC turbine steam supply isolation valve (FCV 71-3)	MO Gate	Outside	DC	DC

Initiation Signals	Group 6	Valve Type	Location Ref. to Drywell	Power to Open (3)	Power to Close (4)
Rx low level +11" Hi drywell press +2.45 psig Hi Rad Rx bldg ventilation ~~400~~ 72 mr/hr. (PKH 1/30/87) Hi Rad refuel zone ~~100~~ 67 mr/hr (PKH 1/30/87)	Drywell nitrogen purge inlet isolation valves (FCV-76-18)	AO butter-fly	Outside	Air/AC	Spring
	Suppression chamber nitrogen purge inlet isolation valves (FCV-76-19)	AO Butter-fly	Outside	Air/AC	Spring
	Drywell main exhaust isolation valves (FCV-64-29 and 30)	AO Butter-fly	Outside	Air/AC	Spring

NOTE: O & MR 294

Table 1
(continued)

Initiation Signals	Group 6	Valve Type	Location Ref. to Drywell	Power to Open (3)	Power to Close (4)
	Suppression chamber main exhaust isol. valves (FCV-64-32 and 33)	AO Butterfly	Outside	Air/AC	Spring
	Drywell/ suppression chamber purge inlet (FCV-64-17)	AO Butterfly	Outside	Air/AC	Spring
	Drywell atmosphere purge inlet (FCV-64-18)	AO Butterfly	Outside	Air/AC	Spring
	Drywell hydrogen sample line valves analyzer A (FSV-76-49)	SO Gate	Inside	AC	Spring
	Drywell hydrogen sample line valves analyzer A (FSV-76-50)	SO Gate	Outside	AC	Spring
	Drywell oxygen sample line valves analyzer A (FSV-76-51)	SO Gate	Inside	AC	Spring
	Drywell oxygen sample line valves analyzer A (FSV-76-52)	SO Gate	Outside	AC	Spring
	Torus oxygen sample line valves analyzer A (FSV-76-53)	SO Gate	Inside	AC	Spring

Table 1
(continued)

Initiation Signals	Group 6	Valve Type	Location Ref. to Drywell	Power to Open (3)	Power to Close (4)
	Torus oxygen sample line valves analyzer A (FSV-76-54)	SO Gate	Outside	AC	Spring
	Torus hydrogen sample line valves analyzer A (FSV-76-55)	SO Gate	Inside	AC	Spring
	Torus hydrogen sample line valves analyzer A (FSV-76-56)	SO Gate	Outside	AC	Spring
	Sample return valves - Analyzer A (FSV-76-57)	SO Gate	Inside	AC	Spring
	Sample return valves - Analyzer A (FSV-76-58)	SO Gate	Outside	AC	Spring
	Drywell hydrogen sample line valves - Analyzer B (FSV-76-59)	SO Gate	Inside	AC	Spring
	Drywell hydrogen sample line valves - Analyzer B (FSV-76-60)	SO Gate	Outside	AC	Spring
	Drywell oxygen sample line valves - Analyzer B (FSV-76-61)	SO Gate	Inside	AC	Spring

Table 1
(continued)

Initiation Signals	Group 6	Valve Type	Location Ref. to Drywell	Power to Open (3)	Power to Close (4)
	Drywell oxygen sample line valves - Analyzer B (FSV-76-62)	SO Gate	Outside	AC	Spring
	Torus oxygen sample line valves - Analyzer B (FSV-76-63)	SO Gate	Inside	AC	Spring
	Torus oxygen sample line valves - Analyzer B (FSV-76-64)	SO Gate	Outside	AC	Spring
	Torus hydrogen sample line valves - Analyzer B (FSV-76-65)	SO Gate	Inside	AC	Spring
	Torus hydrogen sample line valves - Analyzer B (FSV-76-66)	SO Gate	Outside	AC	Spring
	Sample return valves - Analyzer B (FSV-76-67)	SO Gate	Inside	AC	Spring
	Sample return valves - Analyzer B (FSV-76-68)	SO Gate	Outside	AC	Spring

Table 1
(continued)

Initiation Signals	Group 6	Valve Type	Location Ref. to Drywell	Power to Open (3)	Power to Close (4)
	Suppression chamber purge inlet (FCV-64-19)	AO Butter-fly	Outside	Air/AC	Spring
	Drywell/ suppression chamber nitrogen purge inlet (FCV-76-17)	AO Butter-fly	Outside	Air/AC	Spring
	Drywell exhaust valve bypass to standby gas treatment system (FCV-64-31)	AO Butter-fly	Outside	Air/AC	Spring
	Suppression chamber exhaust valve bypass to standby gas treatment system (FCV-64-34)	AO Butter-fly	Outside	Air/AC	Spring
	Drywell/ suppression chamber nitrogen purge inlet (FCV-76-24)	AO Butter-fly	Outside	Air/AC	Spring
	System suction isolation valves to air compressors "A" and "B" (FCV-32-62, 63)	AO Valve	Outside	Air/AC	Spring

2.4 Plant Drawings (Continued)

2.4.4 45N1631-18, Wiring Diagram 120V AC/250V DC Valves and Misc. Connection Diagram

2.4.5 47A1366-32 - series, Valve Tabulation of Marker Tags

2.4.6 47B601-32 - series, Instrument Tabulation

2.4.7 1-47E610-32-2, Mechanical Control Diagram Control Air System

2.4.8 1-47E610-76-1, Mechanical Control Diagram Containment Inerting System

2.4.9 1-47E1847-6,10, Flow Diagram Coutrol Air System

2.4.10 47W611-32-2, Mechanical Logic Diagram Drywell Air Compressor

2.5 Vendor Manuals

2.5.1 Ingersoll - Rand Instructions and Parts List model 2 Air Dryer (Form 1136B) Contract 75472 CVM #52

2.5.2 Ingersoll - Rand Instructions Finger Valve 1 through 3 horsepower Type 30 Compressors (Model 23 ANL and 235 HNL) (Form AP-0145) Contract 75472 CVM #52

3.0 PRECAUTIONS AND LIMITATIONS

3.1 DRYWELL CONTROL AIR COMPRESSOR SUCTION valves, 1-FCV-32-62 and 1-FCV-32-63, will close on any of the following Group VI isolation signals:

3.1.1 Low Reactor Water Level (+ 11 inches).

3.1.2 Drywell High Pressure (2.45 psig).

3.1.3 Reactor Building Ventilation Radiation High (72 mr/hr).

3.2 DRYWELL CONTROL AIR COMPRESSOR SUCTION valves, 1-FCV-32-62 and 1-FCV-32-63, will close on loss of Plant Control Air Supply.

3.3 The Drywell Control Air Compressors will trip on low oil level in the crankcase.

Question 2.07 (3.00)

Concerning the CRD system:

a. WHAT are the normal values for CRD hydraulic system FLOW and DRIVE WATER DIFFERENTIAL PRESSURE? (.5)

b. WHAT percentage of CRD hydraulic system FLOW is supplied to the CRD cooling water header? (1.0)

c. Immediately following a reactor scram the control rod full-in (green) lights on panel 9-5 are lit but there is no position readout displayed. EXPLAIN WHY this occurs and WHAT eventually happens that allows the control rod to settle into the 00 position. (1.5)

Answer:

a. 45 to 65 gpm (accept 0.25 to 0.33 gpm per CRD)
260 psid (accept 250 to 270 psid)

b. 100% (accept "all")

c. Following a scram, but before the SDV is full, the control rod will be in the over travel-in position since there is still a large D/P across the piston.

After the SDV is full, there is no D/P across the piston and the control rod will settle into the 00 position.

Reference:

BFNP: OPL171.005, CRDH, pp. 9, 10, 24 through 29, and 40.
L.O. M, O, and S

1752Q

Question 2.07 (3.00) (continued)

TVA Comment:

a. The normal valve for CRD hydraulic system flow given in the answer key (45 to 65 gpm) is the flow to the drive and cooling water headers and is the Indicated system flow on panel 9-5. The total system flow however includes 4 to 6 gpm (REF BF 12.24, pg. 81 attached) to each of the Reactor Recirculation Pumps and 20 gpm (REF OPL171.005, pg. 18) pump minimum flow which are not seen by the flow indication. The total CRDH system flow can thus be as high as 97 gpm. An answer of 45 to 100 gpm should be accepted for full credit.

b. The percentage of flow which is directed to the cooling water header will vary based on the point used to calculate CRD hydraulic system flow in part a. However, even if the 45 to 65 gpm throught the flow element is used as the system flow, at least part of the flow through the stabilizing valves (~ 2 gpm) does not go through the cooling water header but goes through the exhaust header orificed check valve and lifts the 40D valve on some rods to relieve to the reactor. The flow through the cooling water header is something less than 100% and each answer should be evaluated individually based on the students assumptions.

Resolution:

a. Full credit should be given for:
45-65 gpm as stated in answer key or expand the answer key to accept 45 to 100 gpm.

b. change to reflect full credit for <100% flow

1752Q

ATTACHMENT 6
(Continued)

Elevation 565 (Continued)

Unit 2

	2300-0700	0700-1500	1500-2300
Core Spray Sparger Break (SI-2)			
PdIS 75-28			
PdIS 75-56			
Ventilation (Rx Bldg 480-V Vent Bd 2B)			
Rx Zone Supply Fan A (OFF, SLOW, FAST)			
Rx Zone Supply Fan B (OFF, SLOW, FAST)			
Refuel Zone Supply Fan A (OFF, SLOW, FAST)			
Refuel Zone Supply Fan B (OFF, SLOW, FAST)			
Reactor Recirc Pump			
A Seal Water Flow (4-6 gpm)			
B Seal Water Flow (4-6 gpm)			
Drywell A/C Suction filter 2 min Blowdown (32-304)	(I)		
Rx Water Level (SI-2)			
LIS-3-52			
LIS-3-62			
Secondary Containment Doors (closed)			
No. 236 Unit 2 to Air Lock (NW)	(I)	(I)	(I)
No. 238 Unit 2 Inside Eqpt Lock (NW)	(I)	(I)	(I)
No. 237 Unit 2 Outside Eqpt Lock (NW)	(I)	(I)	(I)
No. 240 Unit 2 to Elev Shaft (SW)	(I)	(I)	(I)
No. 244 Unit 2 to Air Lock (NE)	(I)	(I)	(I)
No. 242 Unit 2 to Elev Shaft (SE)	(I)	(I)	(I)
CRD HCU manual valve check (visual) (Monday)	(I)		

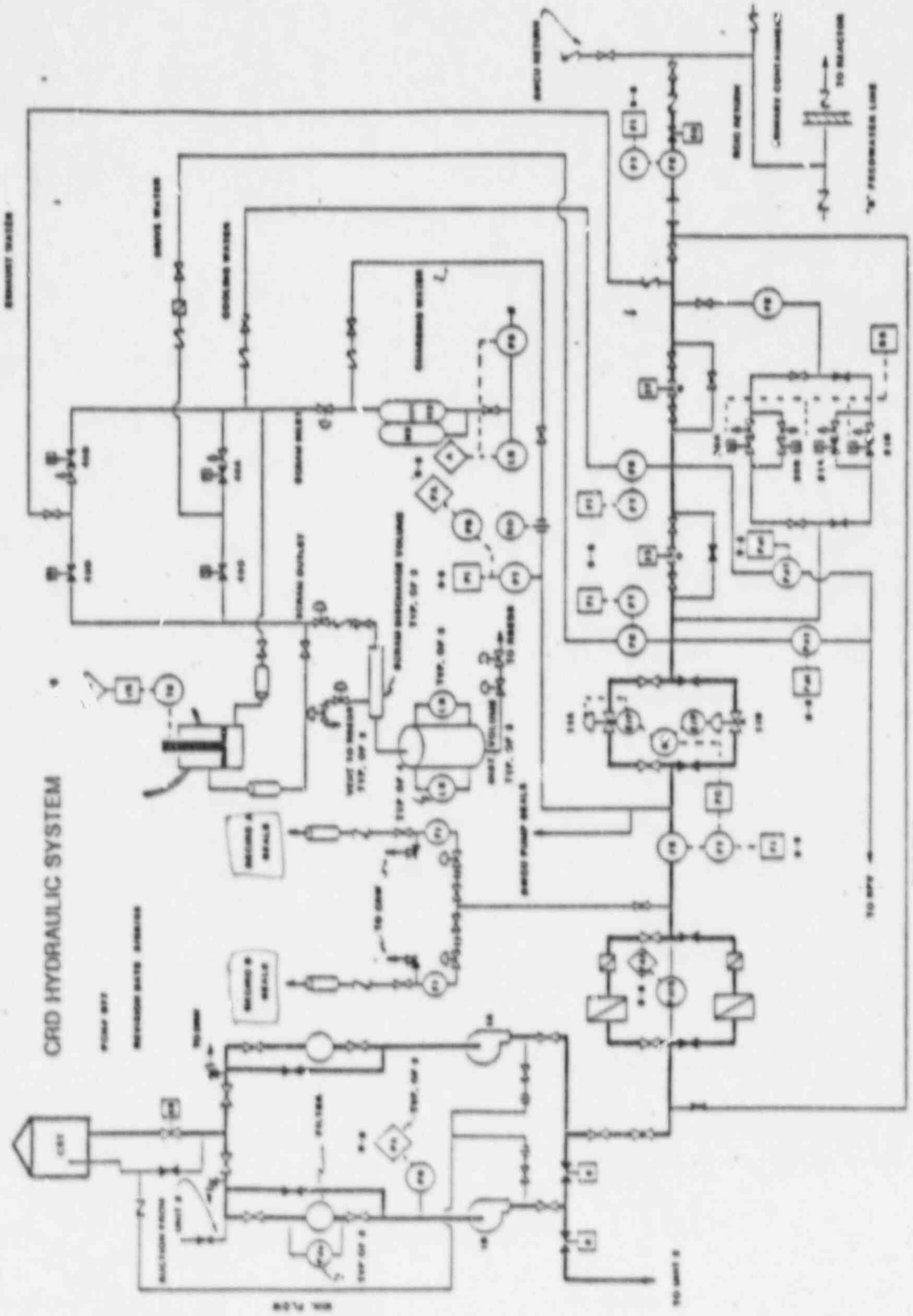

FIGURE 3 CONTROL ROD DRIVE HYDRAULIC SYSTEM (TP-3)

(b) The flow control valve maintains a constant flow of 55-65 GPM through the system. (That is, the flow control valve will have to open further as reactor pressure increases in order to maintain the required system flow.)

(c) If flow stays constant in the system, the pressure drop across the drive and cooling water pressure control valves will stay constant regardless of reactor pressure.

(d) As a result, the drive and cooling water pressure control valves will require adjusting only once (upon system startup) and will not require constant adjustment during a startup or shutdown.

(6) System return line (Figure 6) — TP-6

(a) Flow path

Returns water from the CRD hydraulic system to reactor. — NOTE: GE SIL No. Supplement 2

i. Via cooling water pressure control valves and cooling water supply lines up through drives and into the vessel. Additionally 1-2 gpm is distributed through the exhaust header orificed check valve. This flow unseats the 40D valve at ~ 3 psid and flows to P-over area into vessel. During control rod movement when the selected HCU 40D or 40B valve opens the drive water flows to the exhaust water header. This flow is distributed through the other HCU's 40D valves. This occurs because the 40D valves require only 3 psid to unseat as opposed to 20 psid for the cooling water header flow path.

Question 2.08 (1.50)

Question 6.04 (1.50)

A Core Spray line breaks inside the shroud.

a. WILL the break cause an alarm in the control room (YES or NO)? (.5)

b. HOW will the break affect core spary performance for that loop? (1.0)

Answer:

a. No (.5) (If a core spray line breaks inside the shroud, the differential pressure indicating switch will detect reactor pressure inside the shroud as usual; therefore, no abnormal differential pressure will be indicated.)

b. The core spray loop can perform a flooding function (.5) but its spray will not provide full core spray coverage (.5)

Reference:

BFNP: OPL171.045, Core Spray, pp. 15 and 16
Objective V.K.

TVA Comment:

The answer key requires "flooding function" for full credit; however, an answer which addresses lost of spray function should receive full credit since break was inside shroud as given is question.

TVA Resolution:

Accept lost of spray cooling function for full credit.

Question 6.07 (2.50)

Question 3.1 (2.50)

The plant is operating at 100% power and 100% core flow when the "A" flow converter output fails to zero. MATCH from Column B the action that will exist for each trip function in Column A given the above conditions.

NOTE: REPSONSES MAY BE USED MORE THAN ONCE

COLUMN A	COLUMN B
a. "A" APRM Hi-Hi thermal	1. Rod Block
b. "B" APRM Hi-Hi thermal	2. Half Scram
c. "C" APRM Hi	3. Full Scram
d. "D" APRM Hi	4. None
e. "E" APRM Hi-Hi neutron	

Answer:

a. 2

b. 4

c. 1

d. 4

e. 4

Reference:

BFNP: LP 22, L.O.D

TVA Comment:

Clarification received by several candidates resulted in no credit. The clarification given: conditions in Column 'A' existed in addition to the flow converter 'A' failure. An additional answer should be developed that addresses the question in this context. Therefore a candidate who successfully answers based upon this clarification will not be jeopardized.

TVA Resolution:

Expand the answer key to accept for full credit a correct response to the question taken from the concept of Column 'A' existing in addition to the flow converter failure.

1753Q

Question 3.05 (2.00)

You are in the process of preparing the Main Turbine for startup in accordance with OI-47.III.c. The following conditions exist:

Main Turbine is reset
VALVES CLOSED is selected
Warming rate indicator is at zero position
Load limit is set at 100%
FAST acceleration rate is selected

a. STATE the position for EACH of the following valves with the turbine in this condition.

(1) Main Stop Valves
(2) Control Valves
(3) CIVS Stop
(4) Intercept

b. You now select SHELL WARMING to prewarm the turbine by pressurization of the HP turbine. STATE the new position of the valves, specified in part "a" above, given this changed condition.

Answer:

a. (1) Closed
(2) Closed
(3) Open
(4) Closed

b. (1) No. 2 bypass open
Nos. 1,3,4 closed
(2) Open
(3) Closed
(4) Closed

Reference:

BFNP: LP 10, L.O.D
OI-47

TVA Comment:

Part B: With the initial conditions stated, i.e "warming rate at zero," the number 2 stop valve internal pilot (bypass) will remain closed until the warming rate potentiometer is increased.

The warming rate potentiometer must be at low speed stop (zero position) procedurally and mechanically to select shell or chest warming.

TVA Resolution:

Part B: Change answer key to accept number 2 stop valve internal pilot (bypass) valve closed and stop valves closed should be accepted for full credit.

III. Operating Instructions (Continued)

C. Preparation for Startup (Continued)

1. To reset main turbine (Continued)

b. Depress the master reset pushbutton switch (HS-47-67B) until the emergency trip system TRIPPED light goes out (approximately 3 to 5 seconds).

c. The mechanical trip valve and the vacuum trip will also light their RESET lamps.

d. Observe the following:

1) The No. 2 stop valve is held closed.

2) The No. 1, 3, and 4 main stop valves are held closed by their respective test solenoid valves until the No. 2 main stop valve reaches its full open position.

3) The control valves are held closed.

4) The intercept valves are held closed.

5) The intermediate stop valves will open.

2. To prewarm, by pressurization HP turbine.

NOTE: When the first stage bowl temperature is < 250°F, prewarming by pressurization is necessary. This is to be done as the reactor temperature increases into the heating power range.

a. Check the following permissives met:

1) Turbine reset.

2) VALVES CLOSED selected.

3) Warming rate indicator must be at zero position.

b. Set load limit to 100%.

c. Select FAST acceleration rate.

NOTE: Prior to performing the next step, close the following valves: FCV-1-121, -129, and -137 (LP STM SUPPLY TO RFPTs).

*Revision for pagination

III. Operating Instructions (Continued)

C. Preparation for Startup (Continued)

2. To prewarm, by pressurization HP turbine. (Continued)

d. Open/check open steam leads drain FCV-6-109.

e. Select SHELL WARMING and observe:

1) Shell warming light comes ON.

2) Intercept valves remain CLOSED.

3) Intermediate stop valves go CLOSED.

4) Control valves fully OPEN.

5) Main stop valve No. 2 servo current is at zero.

f. Press INCREASE button until pressure starts to build up in the high pressure turbine.

NOTE: In the event the turbine should roll off turning gear, the governor will limit turbine speed to 100 rpm by closing the control valves.

* NOTE: If turbine rolls off turning gear, decrease flow to zero, wait until zero speed on the turbine then place turbine back on turning gear and repeat the above step as necessary.

g. Monitor high pressure turbine exhaust pressure to maintain 60-100 psig.

* NOTE: Monitor computer point A345(U-1&3) D345 (U-2) continuously to maintain turbine 1st stage pressure ~60-100 psig. Reactor scram may result when in shell warming with stop valves closed and turbine 1st stage pressure $\geq$ 142 psig.

NOTE: The first stage bowl metal temperature differential is limited to 75°F.

NOTE: The temperature rise on the inner first stage bowl metal should not exceed 150°F/hr.

h. Keep differential expansion within limits.

i. Keep HP shell temperature 250-280°F and steam chest temperature 280°F.

*Revision for pagination

III. Operating Instructions (Continued)

C. Preparation for Startup (Continued)

2. To prewarm, by pressurization HP turbine. (Continued)

j. Continue to warm for length of time indicated by Figure 47-2.

→ k. Upon completion of warming, zero flow and select OFF.

NOTE: The control valves will now close and the intermediate valves will open.

l. Open all drain valves.

3. Valve chest warming.

a. Check the following permissives met:

1) Turbine reset.

2) VALVES CLOSED selected.

→ 3) Warming rate indicator must be set at zero.

b. Select CHEST WARMING mode.

NOTE: The control, intercept, and main stop valves should be closed.

c. Slowly increase flow through the No. 2 MSV to establish the required warming rate.

NOTE: The warming rate should be regulated in such a way as to remain within the control valve chest metal temperature differential limits given on Figure 47-1.

d. After steam chest pressure and temperature are at rated and the differential expansion is normal, terminate chest warming by pushing OFF button.

NOTE: The turbine should be rolled within 2-3 hours after completion of the prewarming operations so that unnecessary cooling is avoided.

*Revision for pagination

Question 3.08 (3.00)

Answer EACH of the following with respect to the Rod Sequencer Control System:

a. The RS~~C~~S was developed for three different regions of rod withdrawal:

(1) 100% rod density to 50% rod density
(2) 50% rod density to preset power level
(3) Beyond preset power level

For EACH region above STATE BOTH the design function of the RSCS AND the type of rod control in effect to accomplish this fucntion. (1.5)

b. During a reactor startup under rod sequencer "A" all A12 and A34 rods are fully withdrawn then the Sequencer Mode Selector (SMS) and Rod Sequencer Seclector (RSS) switches are placed in "Normal". LIST four (4) interlocks this action enables. (1.0)

c. State the effect on RSCS if its turbine generator 1st stage shell pressure input fails HIGH. (.5)

Answer:

a. (1) Prevents selection or movement of rods out of sequence (.25)
Sequence Control (.25)

(2) Prevents withdrawal errors within the sequence (.25)
Group Notch Control (.25)

(3) None (RSCS bypassed) (.25)
None (.25)

b. (1) Allows selection of any "B" sequence rod (.25)

(2) Enables group notch control (GNC) logic (.25)

(3) Bypasses the continuous withdraw mode of RMC (.25)

(4) Prevents selection of any "A" sequence rod (.25)

c. Bypasses all rod sequence control logic (.25)

Reference:

BFNP: LP 25, L.O. A & I.1

Question 3.08 (3.00) continued

TVA Comment:

Part a. The purpose (Design Function) of the RSCS system is to restrict control rod movement in the startup and low power ranges. This limits peak full enthalpy to <280 calories/gm upon the postulated rod drop accident. (REF: OPL171.025, p. 3). In any region in which RSCS is enforcing, selection of rods not in the required sequence is prevented. In region from 100% Rod density to 50% Rod density, only one RSCS group A_{12} or A_{34} (B_{12} or B_{34} if starting up using B sequence rods) can be selected. In region from 50% rod density to preset power level only the rods in opposite sequence (B_{12} and B_{34}) can be selected. This region also enforces Group Notch Logic on the individual RSCS groups. Group Notch Logic will keep all rods within a RSCS group within one notch of the other rods in the group (i.e. RSCS does not enforce group insert or withdraw limits)

TVA Resolution:

Part a (100% RD to 50% RD): Restrict control rod movement of rods not in selected sequence.

: Sequence control

Part a (50% and Preset power level): Restrict control rod movement of rods not in selected sequence and enforces group notch control.

: Group Notch Control

1753Q

Question 3.13 (2.50)

Question 6.14 (2.50)

Answer EACH of the following with regard to the 250V Unit and Plant DC power system:

a. LIST three (3) major types of loads supplied by this system. (.75)

b. EXPLAIN how a reliable source of DC power is maintained to these loads. INCLUDE ALL NORMAL, ALTERNATE & BACKUP POWER SUPPLIES AND ASSOCIATED COMPONENTS. (1.0)

c. EXPLAIN why DC power is preferred for these types of load (other thatn for imporived reliability). BE SPECIFIC. THREE RESPONSES REQUIRED FOR FULL CREDIT. (.75)

Answer:

a. (1) DC motor operated valves

(2) DC motor operted pumps

(3) Control power for ECCS

(4) Logic power for ECCS (any 3 @ .25 ea)

b. The DC bus normally is supplied by a battery charger (.25) powered from the 480V AC shutdown board (.25)

Alternate power to the charger is from the 480V common board 1 (manual transfer only) (.25)

Backup power is supplied by a (120 cell lead-acid) battery on a float charge (.25)

c. (1) Provides more constant pull on coils
(2) Absence of hysterisis effects
(3) Absence of eddy current losses (.25 each)

Reference:

BFNP: LP 37, L.O. A, B & C

TVA Comment:

Part a — 3 major types of loads: The objective does state motive power for D.C. powered pumps and motor operated valves. The control and logic power for ECCS. The candidates responses could be more specific. The logic and control provided by the D.C. system is supplied to more than ECCS.

Part b — Reliability of DC is subjective and all Normal, Alternate and Backup power and associated components. This is objective based and relative straight forward. But consider the bold print DC power INCLUDE ALL NORMAL, ALTERNTE AND BACKUP POWER SUPPLIES AND ASSOCIATED COMPONENTS. Considering D.C. only:

(1) normal battery charger
(2) alternate battery charger
(3) the battery itself

Considering A.C.: Both the normal and alternate battery chargers (manual transfer between two) have normal AC from 480V shutdown board with manual transfer to alternate AC from 480V common board.

Part c — Not objective based, more a plant design consideration than a concern of an oprator.

TVA Resolution:

Part a — Anser key should be expaned to reflect credit given for responses stating control power and logic power. Control power may be specified by boards ex: 480V shutdown boards, cooling tower switch gear, 4Kv shutdown boards. Logic power may specify systems. The candidates response should be analyzed and credit given for valid response.

Part b — Candidates should receive credit for a response that addresses the question from the D.C. application. The answer key should be (expanded to reflect a correct response for:
Normal - normal battery cahrger
Alternate - alternate battery charger
Backup (lead acid) battery

Part c — Delete the question or conversely analyze the responses for validity and credit respectively.

Question 7.03

Question 4.04

The following parameter changes / annunciators are observed by the reactor operator:

RBCCW temperature Lower than normal
RBCCW Surge Tank HI Level alarm
(No other alarms present)

a. WHICH one (1) of the following malfunctions would most likely cause these indications: (1.0)

1. Raw Cooling Water leak in the RBCCW Heat Exchanger(s).
2. Reactor Coolant leak into RBCCW via NRHX.
3. Fuel Pool Cooling System leak from RBCCW.
4. RBCCW Makeup Valve (fiol valve) leak.
5. DWEDS Heat Exchanger leak into RBCCW.

b. LIST three (3) of the conditions/circumstances that will cause the isolation valve to non-essential equipment (MOV-48) to automatically close. (1.5)

NOTE: BE SPECIFIC AND INCLUDE SETPOINT VALUES

Answer:

a. 1 (1.0)

b. 1) Low Reactor Water Level <= -114.5 (0.2) and 90.1) DG voltage applied to SD board(s) (0.2)

2) Drywell Pressure > 2.45 psig (0.2) and (0.1) DG voltage applied to SD board(s) (0.2)

3) Low discharge header pressure < 57 psig. (0.5)

Reference:

BFNP: OI 70 LO A, AOI-70, LP 171.047
3.8/4.1 3.3/3.4 2.9/3.2

TVA Comment:

(B) OI-70 list the signals as loss of normal AC power in conjunction with an accident signal or 57 psig header pressure. This should be the correct answer.
LP 171-047 List Signals as
(1) Initiation of Unit 1 and 2 480 volt load shed logic.
(2) Low RBCCW supply header pressure (57 psig)

TVA Resolution:

(B) Accept answer in "B" above as correct for full credit if only two responses are given.)

1757Q

Question 4.13 (1.00)

Question 7.12 (1.00)

LIST two (2) systems that require tagging prior to entry into the Primary Containment. INCLUDE in your answer the required status or position of the system.

Answer:

TIP (.25) withdrawn (.25)
Nitrogen Isolation Valves to Primary Containment (.25) closed (.25)

Reference:

BFNP: BF 14.9 LO A
3.2/3.7 3.2/3.4

Comment:

Per BF 14.9 the Tips are to be withdrawn and tagged also the Nitrogen Isolation Valves to Primary Containment are to be closed and tagged (76-539, 76-541, 76-24, 84-37 and 84-38) as can be seen the Nitrogen systems tagged are Sy. 76 and Sy. 84. Sy. 76 valves are the purge and make up nitrogen valves. Sy. 84 is the CAD valves.

TVA Resolution:

Accept for full credit any two of the following:

1. Tips withdrawn and tagged
2. CAD system isolated and tagged (system 84)
3. Nitrogen isolated and tagged (system 76)

1754Q

Question 7.16

Question 4.14

A single Recirc.lation Pump trips while operating at 100% po'er in automatic control.

a. STATE the immediate action(s) that should be performed on the RUNNING PUMPL.

b. EXPLAIN WHY the Running Pump speed must be reduced to <50% of rated speed prior to starting the idle pump.

Answer:

a. Place Recirculation Subpanel in Manual (.5) and reduce speed to establish 100% loop flow (45,200 gpm) (.5)

b. Prevents excessive Jet Pump vibration.

Reference

TVA Comment

a. OI 68 does say place recirculation subpanel in manual and reduce speed to establish 100% loop flow; however, the same thing could be done with pump in auto using the master controller. The purpose is to reduce flow to within required limits. The method is not fixed as long as actions taken result in 100% loop flow.

TVA Resolution

Revise answer key to only require reduction to 100% loop flow for full credit. Re-assign point value 75% pump flow 25% sub-panel manual.

1757Q

Question 8.03 (2.50)

STATE whether a Radiation Work Permit (RWP) is "REQUIRED" or NOT REQUIRED" for EACH of the situation given below:

a. An employee will need to work in an area having airborne radioactivity of 15% MPC.

b. Work will be done in a designated "RADIATION AREA".

c. Work is to be done in an area with 1500 DPM/100 cm2 loose surface contamination.

d. A radiological survey inside a Contamination Zone will be performed while standing outside the Zone.

e. Trash and procetive clothing will be removed from a Contamination Zone while standing outside the Contamination Zone on the stepoff pad.

Answer:

a. not required
b. not required
c. required
d. not required
e. not required (.5 each)

TVA Comment:

Operations does not do surveys to determine how an area will be zoned and operations does not have equipment to determine airborne or contamination areas. This is done by RADCON. The people had to assume that numbers given in Part 'A' and 'C' would require the area be so zoned in order to get correct answer.

TVA Resolution:

Don't require people to know from memory limits for zones that they don't have equipment to check and are not responsible for doing.

Question 8.09 (2.50)

Unit 1 Technical Specifications specify for REACTIVITY CONTROL . . .

"A sufficient number of control rods shall be operable so that the core could be made subcritical in the most reactive condition during the operating cycle . . ."

LIST the three (3) conditions/assumptions which are used to verify this "Reactivity Margin" (Adequate Shutdown Margin).

Answer:

(1) Highest worth rod (.25) fully withdrawn (.25)
(2) Xenon free core
(3) Cold core (68°F)

Reference:

EIH: U2 TS, 1.0 "SDM"
BFNP: U1 TS, 3.3/4.3A, OPL174.728 LO 9

TVA Comment:

The wording of the question can be misleading as to what response is required. Since question stated "most reactive", it is possible to assume this to mean "cold and xenon free."

TVA Resolution:

Accept as another response for full credit:

1. Strongest control rod fully withdrawn
2. All other operable control rod fully inserted
3. .38% ΔK/K margin

1758Q

Question 8.10 (1.50)

STATE the six (6) ITEMS to be recorded in the daily journal when the Reactor is declared "critical" during a Reactor startup in accordance with GP 100-1.

Answer:

Time
Rod Group
Rod Number
Rod Notch
Period
Recirc Loop Temperature

Reference:

BFNP: OPL171.174.724, LO 6

TVA Comment:

Rod group is not listed in GOI 100-1 as one of the items to be recorded when declare Reactor critical.

TVA Resolution:

Change key to delete 'Rod Group' from answer key and accept (5) five responses for full credit.

1758Q

Section III. Startup (Continued) INITIALS/TIME/DATE

A. Criticality (Continued)

****

CAUTION

DURING A HOT STARTUP FOLLOWING A REACTOR SCRAM AT HIGH POWER, THE CONDITIONS OF PEAK XENON WITH NO MODERATOR VOIDS COULD EXIST AT THE TIME OF STARTUP. UNDER THESE CONDITIONS, EXTREMELY HIGH ROD NOTCH WORTHS CAN BE ENCOUNTERED.

****

4. Upon approval of the shift engineer, start control rod withdrawal in accordance with OI-85. (R)_____/ /_____

NOTE: Shift all SRM and IRM recorders to fast speed prior to criticality and return to slow speed after initial period measurements are calculated.

NOTE: Within the approved control rod withdrawal sequence, it is possible to have a period less than 60 seconds. If a period less than 30 seconds is observed, insert rods until subcriticality is observed and contact the nuclear engineer and shift engineer before pulling any more rods. Periods less than 5 seconds are reportable to the NRC within 24 hours.

5. Observe the period meter when pulling rods and govern withdrawal rate to avoid having
* a period shorter than 60 seconds. (R)_____/ /_____

* NOTE: Reactor is critical when neutron flux rises on a constant (stable) period without further control rod movement.

6. When critical, record time, rod position, rod notch, period, and reactor water temperature
* from recirculation loop A in daily journal. (R)_____/ /_____

NOTE: Measure period as follows:
For 10% power rise, multiply time of rise by 10.5.
For doubling time, multiply time of rise by 1.445.
For decade rise, divide time of rise by 2.3.

* For direct period measurement when on IRMs:
* a. Time 25 to 68 on black scale ranges
* b. Time 8 to 22 on red scale ranges

* Revision

Question 8.12 (2.00)

DESCRIBE the four (4) standards (i.e. symbols/colors) used in marking TEMPORARY ALTERATIONS on plant drawings and WHAT they mean.

Answer:

1. Green - information deleted (by the TEMPALT)
2. Red - information added (by the TEMPALT)
3. Red circle - surrounds area affected (by the TEMPLAT)
4. TACF # - number assigned to track the TEMPLAT and is placed beside the red circle.

Reference:

BFNP: PMI-8.1, L.O. F

TVA Comment:

PMI 8.1 have been revised (revision attached) and changed the color requirements or were intended to be changed. The new revision has you circle affected area in yellow in one part, but says place TACF # beside Red circle in another part. The new revision was placed in Required Reading so some people may respond using new colors..

TVA Resolution:

Accept for full credit: Yellow or red for color on area to be circled.

1758Q

5.2 (Continued)

i. (Continued)

Green - information to be deleted by temporary alteration.

Red - information to be added by temporary alteration.

Yellow- circle the area affected by temporary alteration.

TACF# - to be written beside red circle (the originator is responsible for placing this number on the drawings after the SE has assigned a TACF number).

j. DNE Drafting Services is responsible for updating the as-constructed plant drawings affected by TACFs. The drawings should be revised and distributed in accordance with Standard Practice BF-2.5.

k. In the event the SE deems it necessary for the temporary alteration to be placed more quickly than the above procedure will allow (but the condition is not an emergency), the SE can direct the originator to mark up the SE's office copy and the affected control room(s) copies of the as-constructed drawings. (The standards for marking drawings listed in Paragraph 5.2.3.i above will be used). When this is done, the STA will verify the accuracy of the drawing changes made by the originator. It should be stressed that this is not the normal procedure to follow, but when and if it is followed, the originator is still responsible for taking a copy of the marked up drawings to DNE Drafting Services for update and distribution in accordance with Standard Practice BF-2.5 within 24 hours.

After installation, the SE's clerk will make two copies of the TACF. One copy will be mailed to the Technical Services System Engineering section. The other copy will be mailed to Planning and Scheduling.

5.2 (Continued)

g. On the TACF, under the section, "Effects, Limitation(s), and/or Actions," the originator should briefly describe the effect(s) of the temporary alteration. A detailed explanation is required where the temporary alteration has an effect on the system or other systems that may jeopardize the safe and continued operation of the plant. Note any limitation and/or action required during the period that the temporary alteration may exist. Explicit information shall be noted for situations that may require immediate operator action. List any requirements which must be completed prior to removal of temporary alterations such as approval of DCR, clearance of nonconforming item, etc. If a system or component cannot be made operable with the temporary alteration in place, it shall be so stated in this section of the TACF.

h. On the TACF on the lines, Tests That Will Be Performed To Prove Operability After TACF Installation and Tests That Will Be Performed To Prove Operability After TACF Removal, the orginator shall list all tests which will be done after installation and after removal of the temporary alteration. These tests should be written and performed (a) to assure system integrity and (b) to provide for evaluating the performance of the alteration before system operation. If the originator believes that testing is not required, he should provide a brief justification of why testing is not required.

i. The originator is responsible for supplying two sets of marked up drawings with the TACF. These drawings will be stamped "For Information Only". These drawings will show the configuration of the affected equipment after installation of the temporary alteration. One set of drawings will be used by DNE Drafting Services as a reference for marking up the original drawings. One will remain with the original TACF in the TACF file as a reference copy. If time permits, the TACF originator should work with the DNE Drafting Services to determine which drawings need to be marked up and included with the TACF file. The Shift Engineer's controlled copy of the as-constructed drawings and the affected unit control room's as-constructed drawings, shall be marked before the system is declared operable. The following standards will be used in marking drawings:

ENCLOSURE 4

SIMULATION FACILITY FIDELITY REPORT

Facility Licensee:	Tennessee Valley Authority
Facility Licensee Docket No.:	50-259, 50-260, and 50-296
Facility Licensee No.:	DPR-33, DPR-52, and DPR-68
Operating Tests administered at:	Browns Ferry Nuclear Plant
Operating Tests Given On:	May 2-12, 1988

During the conduct of the simulator portion of the operating tests identified above, the following apparent performance and/or human factors discrepancies were observed:

1. The CRD system modeling is inaccurate in that cooling water header d/p does not go below 30 psid during normal system operation, while it should indicate approximately 20 psid.

2. Feedwater system modeling interacts with recirculation pump operation such that a recirculation pump runback proceeds down to approximately 52% flow while the plants' procedural runback specification is approximately 75% flow.

3. Plant procedure allows 3 element level control at 10% power and the simulator does not respond adequately at such a low power. This may be the result of a procedural or modeling problem. Candidates appeared unfamiliar with the simulator's response and devoted significant time to investigative efforts during the examination.

4. The RBCCW system displayed a modeling problem in that when a slow degradation in flow to approximately 90% by the partial closure of the return from the drywell valve was simulated, an inappropriately rapid response (2 to 3 seconds) in the temperature increase was indicated.

5. The simulator's copy of OI-68, did not have attachment C to which the candidate had been procedurally referenced. This may be a result of the many recent procedural changes. Checks should be made on all recent OI changes, and more care should be given to ensure proper referencing is maintained when such changes are made.

6. While at 75% power one MSIV was simulated to close. The simulator modeling gave a serious EHC problem which resulted in severe pressure transients of such duration and magnitude as to lead the operator to manually scram the reactor.

7. The remote closure of the suction from the suppression pool to the RHR pumps was poorly modeled such as to allow continued pump operation.

8. The simulator self-initiated three events that were programed for use later in the scenario.