TENNESSEE VALLEY AUTHORITY
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AUG 11 1987

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U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Attention: Document Control Desk
Washington, DC 20555

Gentlemen:

SEQUOYAH NUCLEAR PLANT, UNITS 1 AND 2 - NUREG-1150 (REACTOR RISK REFERENCE DOCUMENT)

Please refer to my letter dated July 31, 1987.

Enclosed is TVA's response to the request for additional technical information on Sequoyah submitted by James G. Keppler's letter to S. A. White dated July 23, 1987. If you have any questions, please telephone D. L. Williams at (615) 632-7170.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R Gridley

R. L. Gridley, Director
Nuclear Safety and Licensing

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ENCLOSURE

Response to Request for Additional Information
Letter from James G. Keppler to S. A. White
Dated July 23, 1987

Comments

1. Please provide the probability data and the calculational basis to justify a frequency for loss of offsite power of less than 7E-2 per year.

8. We are currently using Cluster 7 from NUREG-1032 for probabilities for failure to restore offsite ac power. Please provide any justification or data you have to support a lower (i.e., better) curve for recovery of ac power at Sequoyah.

Response

Questions 1 and 8 related to the frequency and duration of loss of offsite power. NUREG-1032, "Evaluation of Station Blackout Accidents at Nuclear Power Plants (Draft)," is cited as the reference for this information in the NUREG-1150 analysis. However, TVA's analysis based on the criteria outlined in NUREG-1032 indicates that Sequoyah should be considered a cluster group 2 plant for loss of offsite power initiating event frequency instead of cluster group 7 as assumed in the NUREG-1150 analysis. Therefore, we believe using the cluster group 2 data is appropriate for SQN. Attachment A provides information previously supplied to EI Services (NRC subcontractor on this program).

Comment

2. Please provide your estimate of battery depletion time during station blackout sequences and the basis.

Response

The Sequoyah design basis for battery depletion time under station blackout conditions is two hours (reference FSAR section 8.3.2). The 125V dc batteries at Sequoyah are tested at least once every 18 months in accordance with SI-105 (Attachment B) to ensure a minimum discharge time of two hours. Also, the manufacturer specification on the batteries specifies a minimum of two hours to discharge.

A separate TVA analysis supporting the four-hour battery depletion time used by NRC in the NUREG-1150 analysis does not exist. However, additional information is available to support this assumption. A successful test simulating loss of ac power was performed by TVA as a part of the special low power testing program at Sequoyah. Also, as part of a station blackout risk study for TVA's Browns Ferry Nuclear Plant performed by Oak Ridge National Laboratory (NUREG/CR-2182), TVA determined that the four hour battery depletion time initially assumed in the study could be extended to seven hours. We expect that a similar analysis for the Sequoyah batteries would provide comparable results. TVA plans to pursue this matter as part of the current industry initiatives to address NRC's unresolved safety issue A-44. Given this data and our experience with risk-based evaluations, it is our judgment that the battery depletion time used in NUREG-1150 is reasonable.

Comment

3. A primary sequence of interest is the reactor coolant pump (RCP) seal loss of coolant accident (LOCA) after loss of all seal cooling due to total loss of plant service water or component cooling water. Please provide any test results or engineering analyses to establish:

    a. the time to failure of RCP seals after loss of seal cooling (and leak rate); and

    b. the ability of the centrifugal charging pumps to operate after a failure of the component cooling system.

Response

a. The time of failure of RCP seals after loss of seal cooling (and the leak rate) is available in Westinghouse WCAP-10541, "Reactor Coolant Pump Seal Performance Following a Loss of All AC Power," Revision 2. A copy of this WCAP has previously been submitted to NRC by the Westinghouse Owners' Group (reference Westinghouse letter OG-206 dated December 10, 1986, from L. D. Butterfield to J. Lyons). This information applies to SQN.

b. Testing has been conducted to show the centrifugal charging pump (CCP) operation is not degraded by the loss of component cooling (CCS) for a period of at least 24 hours. This testing is discussed in an April 7, 1987 letter from M. J. Hitchler (Westinghouse) to W. Mims (TVA), a copy of which is provided as Attachment C.

Comment

4. Please provide thermal/hydraulic analysis results showing containment pressure time histories for small (2" and 1/2") LOCAs after actuation of the containment sprays.

Response

Containment pressure time histories for small break LOCAs (2-inch) are covered by IDCOR Task 23.1S; "Sequoyah Nuclear Plant: Integrated Containment Analysis," a copy of which is provided as Attachment D. Similar information on 1/2-inch LOCAs is not available; however, it is our understanding that the submittal of this IDCOR report is responsive to the staff's request.

Comment

5. Please provide the results of analyses which show rates of temperature rise in the switchgear rooms upon loss of heating, ventilation or air conditioning (HVAC) to the rooms.

Response

Engineering calculation TI-ECS-61, Revision 1 (Attachment E) provides "Electric Board Room Temperature Profiles Versus Time Upon Loss Of Cooling." This calculation assumes loss of all HVAC and considers operator actions. In addition, engineering calculation TI-ECS-69 (Attachment F) provides a similar analysis assuming availability of an air handling unit to circulate air within the affected spaces.

Comment

6. Please provide plant-specific data for diesel generator failure to start and diesel generator test/maintenance outages.

Response

Attachment G provides information concerning diesel generator availability at Sequoyah. TVA agrees that the diesel generator failure rates used in NUREG-1150 are reasonable.

Comment

7. Please send latest revision of all emergency procedures, functional restoration procedures, emergency contingency actions, and operating procedures for loss of component cooling water, essential raw cooling water, instrument air, and a vital bus.

Response

Attachment H identifies the procedures requested by NRC. Copies of these procedures are enclosed in this transmittal.

ATTACHMENT A

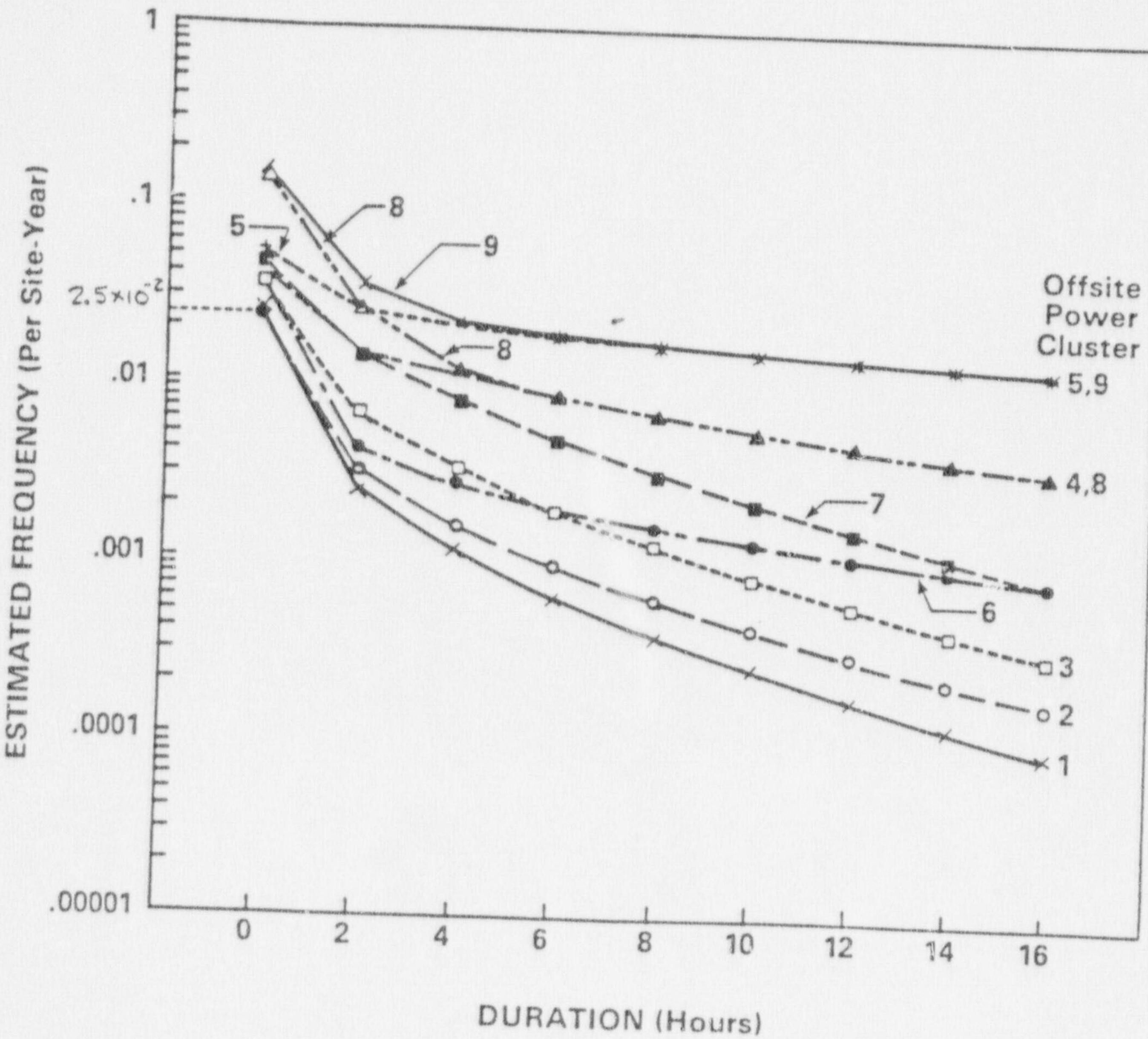

Figure A.14 Estimated frequency of occurrence of losses of offsite power exceeding specified durations for nine offsite power clusters

Table A.11 Identification of grid (GR), offsite power system design (I), severe weather (SR), and extremely severe weather (SS) factors included in nine cluster groups

Cluster Group 1

GR	I	SR	SS
1	1	1	1
1	1	2	1
1	2	1	1
1	2	2	1
2	1	1	1
2	1	2	1
2	2	1	1
2	2	2	1

Cluster Group 2

GR	I	SR	SS
1	1	1	2
1	1	2	2
1	1	3	1
1	1	4	1
1	1	4	2
1	2	1	2
1	2	2	2
1	2	3	1
1	2	4	1
1	2	4	2
1	3	1	1
1	3	2	1
2	1	1	2
2	1	2	2

Cluster Group 2 (Cont'd)

GR	I	SR	SS
2	1	3	1
2	1	4	1
2	1	4	2
2	2	1	2
2	2	2	2
2	2	3	1
2	2	4	1
2	2	4	2
2	3	1	1
2	3	2	1

Cluster Group 3

GR	I	SR	SS
1	1	3	2
1	1	5	1
1	1	5	2
1	2	3	2
1	2	5	1
1	2	5	2
1	3	1	2
1	3	2	2
1	3	3	1
1	3	3	2
1	3	4	1
1	3	4	2

Cluster Group 3 (Cont'd)

GR	I	SR	SS
1	3	5	1
1	3	5	2
2	1	3	2
2	1	5	1
2	1	5	2
2	2	3	2
2	2	5	1
2	2	5	2
2	3	1	2
2	3	2	2
2	3	3	1
2	3	3	2
2	3	4	1
2	3	4	2
2	3	5	1
2	3	5	2

Cluster Group 4

GR	I	SR	SS
1	1	1	4
1	1	2	4
1	1	3	4
1	1	4	4
1	1	5	4
1	1	6	3

Table A.6 Grid reliability/recovery

Grid reliability group (G)	Frequency of grid loss
G1	Less than 1 per 60 site-years (0.01/site-year)
G2	≥ 1 per 60 site-years and < 1 per 30 site-years (0.03/site-year)
G3	> 1 per 20 site-years and < 1 per 6 site-years (0.1/site-year)
G4	Greater than or equal to 1 per 6 site-years (0.3/site-year)

Recovery (R)

Recovery from grid blackout group (R)	Recovery capability
R1	Plant has capability and procedures to recover offsite (non-emergency) AC power to the site within 1/2 hour following a grid blackout.
R2	All other plants not in R1.

Grid reliability/recovery (GR)

Grid reliability/recovery group (GR)	Grid reliability group (G)	Recovery from grid blackout group (R)
GR1	G1	R1
GR2	G2	R1
GR3	G3	R1
GR4	G4	R1
GR5	G1	R2
GR6	G2	R2
GR7	G3	R2

Table A.3 Mean time to restore offsite power and statistical test values for plant design groupings

Group designation	Design features*	Mean time to restore offsite power (hrs)
I1	A3 and (B3, B4 or B2b)	0.13
I2	A3 and (B1 or B2a)	0.21
I3	(A1 or A2) and (B3, B4, or B2b)	0.50
I4	(A1 or A2) and (B1 or B2a)	0.97

Statistical Test Values

Test	Design factor	F value	Pr F
Test for interaction	A	7.01	0.0132
	B	1.67	0.2062
	A*B	0.85	0.3637
Test for main effects	A	6.92	0.0135
	B	2.68	0.1125

*A1, A2, A3, B1, B2, B3, and B4 are defined in Table A.2.

Note: Frequency of plant-centered loss-of-offsite-power events was 0.056 per site-year.

Table A.2 Definitions of offsite power system design factors

Major design factor	Design features
A. Independence of offsite power sources to the nuclear power plant	1. All offsite power sources are connected to the plant through one switchyard.
	2. All offsite power sources are connected to the plant through two or more switchyards, and the switchyards are electrically connected.
	3. All offsite power sources are connected to the plant through two or more switchyards or separate incoming transmission lines, but at least one of the AC sources is electrically independent of the others.
B. Automatic and manual transfer schemes for the Class 1E buses when the normal source of AC power fails and when the backup sources of offsite power fail	1. If the normal source of AC power fails, there are no automatic transfers and one or more manual transfers to preferred or alternate offsite power sources.
	2. If the normal source of AC power fails, there is one automatic transfer but no manual transfers to prefer-red or alternate off-site power sources.
	a. All of the Class 1E buses in a unit are connected to the same preferred power source after the automatic transfer of power sources.
	b. The Class 1E buses in a unit are connected to separate offsite power sources after the automatic transfer of power sources.
	3. After loss of the normal AC power source, there is one automatic transfer. If this source fails, there may be one or more manual transfers of power sources to preferred or alternate offsite power sources.

Table A.2 (continued)

Major design factor	Design features
	a. All of the Class 1E buses in a unit are connected to one preferred power source after the first automatic transfer. b. The Class 1E buses in a unit are connected to separate offsite power sources after the first automatic transfer. 4. If the normal source of AC power fails, there is an automatic transfer to a preferred source of power. If this preferred source of power fails, there is an automatic transfer to another source of offsite power. a. All of the Class 1E buses in a unit are connected to the same preferred power source after the first automatic transfer. b. The Class 1E buses in a unit are connected to separate offsite power sources after the first automatic transfer of power sources.

Table A.8 Severe-weather-induced loss-of-offsite-power frequency/recovery

Severe-weather-induced loss-of-offsite-power frequency (S)	
Frequency group (S)	Frequency of severe weather-induced loss of offsite power
S1	Less than 1 per 350 site-years (0.002/site-year)
S2	≥ 1 per 350 site-years and < 1 per 120 site-years (0.005/site-year)
S3	Greater than or equal to 1 per 120 site-years (0.015/site-years)

Recovery (R)	
Recovery from severe-weather-induced loss-of-offsite-power groups (R)	Recovery capability
R1	Plant has capability and procedures to recover offsite (non-emergency) AC power to the site within 2 hours following a severe-weather-induced loss of offsite power.
R2	All other plants not in R1

Severe-weather-induced loss-of-offsite-power frequency/recovery (SR)		
Severe-weather-induced loss-of-offsite-power frequency/recovery group (SR)	Frequency group (S)	Recovery group (R)
SR1	S1	R1
SR2	S2	R1
SR3	S3	R1
SR4	S1	R2
SR5	S2	R2
SR6	S3	R2

Table A.9 Extremely severe-weather-induced loss-of-offsite-power frequency

Frequency groups(SS)	Extremely severe-weather-induced loss-of-offsite-power frequency
SS1	Less than 1 per 3500 site-years (0.0002/site-year)
SS2	≥ 1 per 3500 site-years and < 1 per 1200 site-years (0.0005/site-year)
SS3	≥ 1 per 1200 site-years and < 1 per 350 site-years (0.0015/site-year)
SS4	≥ 1 per 350 site-years and < 1 per 120 site-years (0.005/site-year)
SS5	Greater than or equal to 1 per 120 site-years (0.015/site-year)