STEAM TURBINE INFORMATION

TURBINE MISSILE REPORT

RESULTS OF PROBABILITY ANALYSES
OF DISC RUPTURE AND MISSILE GENERATION

CT-25266

REVISION 0

NOVEMBER 1986

DUQUESNE LIGHT COMPANY

BEAVER VALLEY STATIONS

PARTIALLY INTEGRAL SPARE ROTORS - PGE96471/2

WESTINGHOUSE ELECTRIC CORPORATION

POWER GENERATION OPERATING DIVISION

MISSILE PROBABILITIES

1. The probabilities for disc rupture and missile generation resulting from stress corrosion are shown in Tables III and IV including the probability for each disc as well as the overall probability for the machine. These values include the probability of reaching design overspeed where applicable. All probabilities are reported as a numerical value followed by the negative exponent of 10. For example, 1.3-012 means 1.3×10^{-12}.

2. The probability of disc rupture and missile generation due to stress-corrosion is calculated for each disc and the unit in its present running condition taking into account specific disc properties and keyway temperatures. The probabilities have been calculated for both the rated speed and the design overspeed as a function of six inspection intervals.

3. The following notes explain the various columns that appear in Tables III & IV.

DISK   -   The disc number.

LP END   -   LP rotor number followed by Generator (GEN) or Governor (GOV) end.

DEL T   -   Inspection interval in operating hours: 8,760 to 87,600 hours has been analyzed. Since these are operating hours, appropriate adjustment should be made for calendar hours if considered necessary.

PROB (R) -   Probability of disc rupture or missile generation at rated speed.

PROB (O)-   Probability of disc rupture or missile generation at design overspeed. This number is lower than that corresponding to rated speed since it includes the probability for reaching design overspeed.

4. The overall probability of disc rupture or missile generation for the entire unit is summarized at the ends of Tables III & IV for six different time intervals and for both rated speed and the design overspeed.

TABLE III

PROBABILITY OF DISC RUPTURE DUE TO STRESS CORROSION

BEAVER VALLEY #2 (DUQUESNE), SPARE LP ROTOR 1 (S.O. PGE9647T)   11-17-8

DISK	LP END	DEL T	PROB(R)	PROB(O)	DISK ID
4	1 GEN	8760.0			TN14324
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
4	1 GOV	8760.0			TN14318
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	1 GEN	8760.0			TN14323
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	1 GOV	8760.0			TN14322
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			

b,c,h

OUTPUT SUMMARY

b,c,h   b,c,h   b,c,h

DEL T = 8760.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 17520.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 26280.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 35040.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 43800.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 87600.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	

TABLE III

PROBABILITY OF DISC RUPTURE DUE TO STRESS CORROSION

BEAVER VALLEY #2 (DUQUESNE), SPARE LP ROTOR 2 (S.O. PGE96472)   11-17-8

DISK	LP END	DEL T	PROB(R)	PROB(O)	DISK ID
4	2 GEN	8760.0			TN14326
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
4	2 GOV	8760.0			TN14325
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	2 GEN	8760.0			TN14338
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	2 GOV	8760.0			TN14343
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			

b,c,h

OUTPUT SUMMARY

b,c,h   b,c,h

DEL T =	8760.0	PROB(R) =		PROB(O) =	
	LP NO. 1	PROB(R) =		PROB(O) =	
	LP NO. 2	PROB(R) =		PROB(O) =	
DEL T =	17520.0	PROB(R) =		PROB(O) =	
	LP NO. 1	PROB(R) =		PROB(O) =	
	LP NO. 2	PROB(R) =		PROB(O) =	
DEL T =	26280.0	PROB(R) =		PROB(O) =	
	LP NO. 1	PROB(R) =		PROB(O) =	
	LP NO. 2	PROB(R) =		PROB(O) =	
DEL T =	35040.0	PROB(R) =		PROB(O) =	
	LP NO. 1	PROB(R) =		PROB(O) =	
	LP NO. 2	PROB(R) =		PROB(O) =	
DEL T =	43800.0	PROB(R) =		PROB(O) =	
	LP NO. 1	PROB(R) =		PROB(O) =	
	LP NO. 2	PROB(R) =		PROB(O) =	
DEL T =	87600.0	PROB(R) =		PROB(O) =	
	LP NO. 1	PROB(R) =		PROB(O) =	
	LP NO. 2	PROB(R) =		PROB(O) =	

TABLE IV

PROBABILITY OF MISSILE GENERATION FROM DISC RUPTURE DUE TO STRESS CORROSION

BEAVER VALLEY #2 (DUQUESNE), SPARE LP ROTOR 1 (S.O. PGE96471)   11-17-8

DISK	LP END	DEL T	PROB(R)	PROB(O)	DISK ID
4	1 GEN	8760.0			TN14324
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
4	1 GOV	8760.0			TN14318
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	1 GEN	8760.0			TN14323
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	1 GOV	8760.0			TN14322
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			

b,c,h

OUTPUT SUMMARY

b,c,h   b,c,h

DEL T = 8760.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 17520.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 26280.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 35040.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 43800.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	
DEL T = 87600.0	PROB(R) =	PROB(O) =	
LP NO. 1	PROB(R) =	PROB(O) =	

TABLE IV

PROBABILITY OF MISSILE GENERATION FROM DISC RUPTURE DUE TO STRESS CORROSION

BEAVER VALLEY #2 (DUQUESNE), SPARE LP ROTOR 2 (S.O. PGE96472)   11-17-8

DISK	LP END	DEL T	PROB(R)	PROB(O)	DISK ID
4	2 GEN	8760.0			TN14326
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
4	2 GOV	8760.0			TN14325
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	2 GEN	8760.0			TN14336
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			
5	2 GOV	8760.0			TN14343
		17520.0			
		26280.0			
		35040.0			
		43800.0			
		87600.0			

b,c,h

OUTPUT SUMMARY

b,c,h   b,c,h

DEL T =	8760.0	PROB(R) =	PROB(O) =
	LP NO. 1	PROB(R) =	PROB(O) =
	LP NO. 2	PROB(R) =	PROB(O) =
DEL T =	17520.0	PROB(R) =	PROB(O) =
	LP NO. 1	PROB(R) =	PROB(O) =
	LP NO. 2	PROB(R) =	PROB(O) =
DEL T =	26280.0	PROB(R) =	PROB(O) =
	LP NO. 1	PROB(R) =	PROB(O) =
	LP NO. 2	PROB(R) =	PROB(O) =
DEL T =	35040.0	PROB(R) =	PROB(O) =
	LP NO. 1	PROB(R) =	PROB(O) =
	LP NO. 2	PROB(R) =	PROB(O) =
DEL T =	43800.0	PROB(R) =	PROB(O) =
	LP NO. 1	PROB(R) =	PROB(O) =
	LP NO. 2	PROB(R) =	PROB(O) =
DEL T =	87600.0	PROB(R) =	PROB(O) =
	LP NO. 1	PROB(R) =	PROB(O) =
	LP NO. 2	PROB(R) =	PROB(O) =