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U.S. Nuclear Regulatory Commission
Washington D.C. 20555

Subject: SEP Topic III-4.B, Turbine Missiles

NRC Docket 50-237

In response to John Schiffkin's request at the June 1 and 2 Dresden site visit, Commonwealth Edison requested and received the following information from General Electric concerning the Dresden 2 turbine.

Q1 - What is the turbine model number?

A1 - Dresden #2 is a code type N1 unit with 38" long last stage buckets. This is a tandem compound unit with three 2-flow low pressure hoods and one double flow high pressure section. This unit is not a current production 38" last stage bucket. The vane pitch diameter is smaller and, consequently, the wheel stresses are lower resultilng in a smaller wheel than is used on current units.

Q2 - What are the weight and location of each turbine wheel?

A2 - Dresden Unit #2 has three similar Low-Pressure Rotors. The wheels are designated by their "stage number" or wheel position location, counting the last stage as "L-0." See the attached Table #1. Note that the location of each wheel is referenced to the cross around inlet centerline. This cross around inlet is where the steam is admitted to the turbine and "splits" (double flow rotor).

Q3 - Is the 1967 report, "An Analysis of Turbine Missile Resulting from Last-Stage Wheel Failure", our latest word on the subject?

A3 - As a result of experimental data obtained by General Electric since 1967, the method for estimating the exit energies and velocities of hypothetical turbine wheel missiles was modified. The method presently in use is described in the attached data folder entitled "An Analysis of the Energy of Hypothetical Wheel Missiles Escaping From Turbine Casings." (Attachment A) Since this method was developed, the Electric Power Research Institure (EPRI) has run a series of tests to evaluate the capability for wheel fragments to penetrate a turbine casing. Calculations made by General Electric were in close agreement with the EPRI data.

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Calculated wheel fragments exit energies and velocities for a typical modern design nuclear low pressure rotor with 38" last stage buckets are contained in the attached Table 2. The ranges of fragment energies and velocities listed are based upon an assumed wheel burst at 180% of normal operating speed. Of course, if a wheel burst was to occur at a lower speed, we would predict lower missile energies and an increased probability of containing the fragments within the LP casing.

The 38" last stage bucket on Dresden #2 has a smaller pitch diameter than the current 38". Due to the lower centrifugal forces, the last stage wheels on Dresden #2 are narrower and, therefore, weigh less than a modern 38" last stage wheel. When considered in relation to missile energies, hypothetical fragments from the lighter 38" wheel would be anticipated to contain less energy than fragments from a modern 38" last stage wheel. Based upon the relative weights of the Dresden #2 last stage wheels and the wheels listed in Table 2, we estimate that the hypothetical missile energies for the last stage wheels of Dresden #2 would be approximated 30% less than listed under Group III of Table 2. Regarding the other wheels on Dresden #2, wheels 1-4 are reasonable characterized by the information provided under Group I of Table 2 while wheels 5-7 are reasonably characterized by the Group II information.

Please address any questions you may have concerning this matter to this office.

One (1) signed original and thirty nine (39) copies of this transmittal have been provided for your use.

Very truly yours,

T J Rausch

T.J. Rausch
Nuclear Licensing
Administrator
Boiling Water Reactors

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Attachment
cc: R III Resident Inspector, Dresden

TABLE 1

LOW PRESSURE TURBINE WHEEL AND BUCKET WEIGHTS

STAGE	WHEEL	VANE & COVER WEIGHT (lbs)	WHEEL WEIGHT (lbs)	TOTAL WEIGHT (lbs)	DISTANCE FROM ℄ INLET TO ℄ WHEEL (inches)
Bearing Centerline					132
14	L-0	2839	12438	15277	87.500
13	L-1	1280	8098	9378	71.500
12	L-2	1277	7288	8565	59.250
11	L-3	1023	6606	7629	48.750
10	L-4	602	5721	6323	38.750
9	L-5	293	5613	5906	29.500
8	L-6	244	5424	5668	20.000
7	L-7	144	4397	4541	8.000
Cross Around Inlet Centerline					0
Bearing Centerline					133.500

NOTE: The LP turbines are double flow and the same weights and dimensions apply to both flows.

TABLE 2

38 INCH LAST STAGE BUCKET, 1800 RPM LOW PRESSURE TURBINE - HYPOTHETICAL MISSILE DATA

STAGE GROUP	I											
Stage Numbers in Group; Number of Representative Stage	1-4; 2				5-7; 6				8 Last; 8			
MISSILE DIMENSIONS	a	b	c	d	a	b	c	d	a	b	c	d
Fragment Group	2	1	3	10	2	1	3	10	2	1	3	10
Number of Fragments in Group	120	60			120	60			120	60		
Sector Angle, Degrees	2000	1000	300	100	3000	1500	500	150	6500	3200	1000	200
Fragment Weight, Pounds												
Radius, in. R_1 Bore	18	18			17	17			16	16		
R_2 Hub	24	24			25	25			25	25		
R_3 Vane Root	45	45			45	45			45	45		
Thickness, in. T_1 Hub	10	10			12	12			21	21		
T_2 Web	3	3			5	5			10	10		
Approximate Rectangular Dimensions, in.			19x19x3	11x11x3			19x19x5	10x10x5			19x19x10	8x8x10

HIGH SPEED BURST	Stage Group I				Stage Group II				Stage Group III			
Postulated Speed: 3240 RPM (180%)												
Fragment Group	a		b		a		b		a		b	
	Energy	Velocity	Energy	Velocity	Energy	Velocity	Energy	Velocity	Energy	Velocity	Energy	Velocity
Minimum	0	0	0	0	0	0	0	0	16	400	0	0
Maximum	7	470	6	620	14	550	13	750	38	610	30	780
Midpoint	3.5	340	3	440	7	390	6.5	530	27	520	15	550
Fragment Group	c		d		c		d		c		d	
	Energy	Velocity	Energy	Velocity	Energy	Velocity	Energy	Velocity	Energy	Velocity	Energy	Velocity
Minimum	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	4	930	2	1130	6	880	2	930	13	910	3	980
Midpoint	2	660	1	800	3	620	1	660	6.5	650	1.5	690

Note: 1) Energy of ejected missiles is given in million foot-pounds, velocity in feet/second.
2) Energies are postulated to be uniformly distributed over stated range.
3) Sixteen missiles in four size classes are postulated to occur per burst.