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SUBJECT: Power Distribution of Tower Shielding Facility Reactor (TSR)

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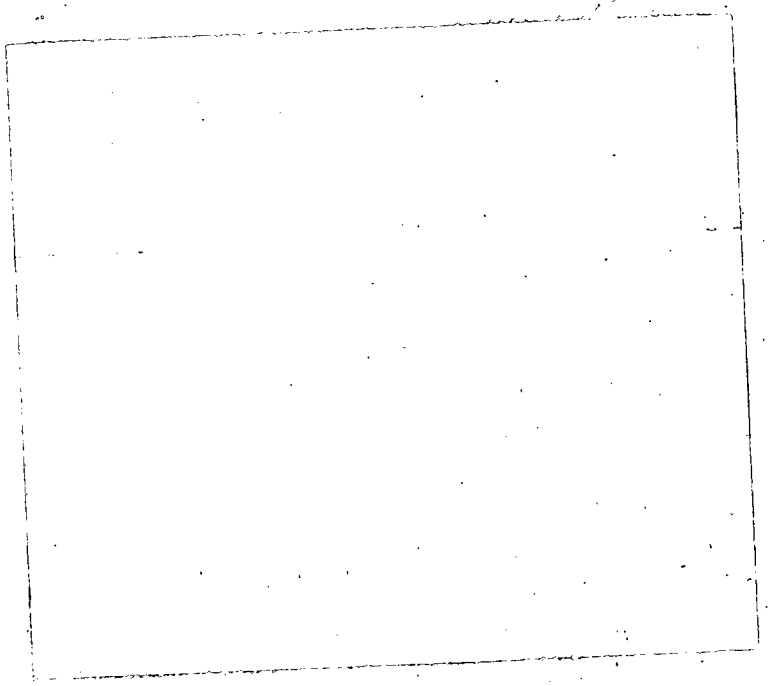

NOTICE

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POWER DISTRIBUTION OF TOWER SHIELDING FACILITY REACTOR (TSR)

Introduction

The horizontal and vertical power distribution for a 5 x 7 fuel element loading of the TSR is presented in this memo. This loading configuration is identical to that used in the GE experiment performed from May to December, 1955.

Vertical Power Distribution

The TSR 5 x 7 loading used in the GE experiment is shown in Fig. 1. Vertical flux traverses were obtained by inserting cobalt wires along the axis of fuel elements located in positions 12, 13 and 15. The reactor was operated at a power of 400 kw for 2 hours and the gamma-ray activity read on the TSF wire scanner.

The experimental results are shown in Fig. 2 and tabulated in Table 1.

Horizontal Power Distribution

The power distribution in the horizontal plane was obtained by "cooling" the reactor for several days to allow for decay of short half-life fission products and then removing and measuring individually the gamma-ray activity of each fuel element with a 900-cc ion chamber. In this manner the average power of each element was determined. Although measurements were not obtained for elements T-34, T-35 and T-36 (safety and control elements), it was estimated that the activity of these elements would be about the same as element T-32 ($\frac{1}{2}$ element).

The experimental results are shown in Figs. 3 and 4 and tabulated in Table 2.

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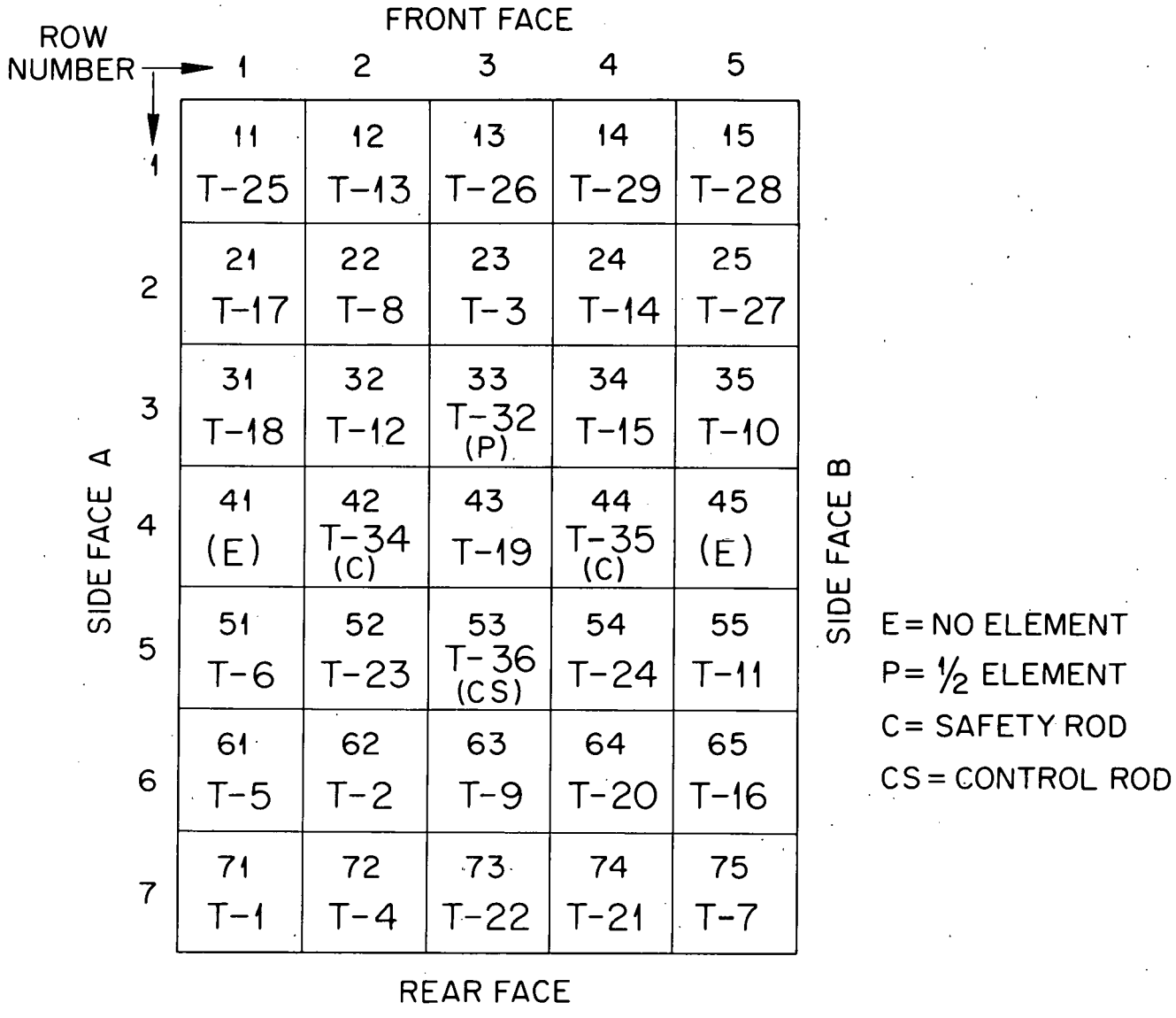

Fig. 1. TSR Fuel Element Loading Number 4.

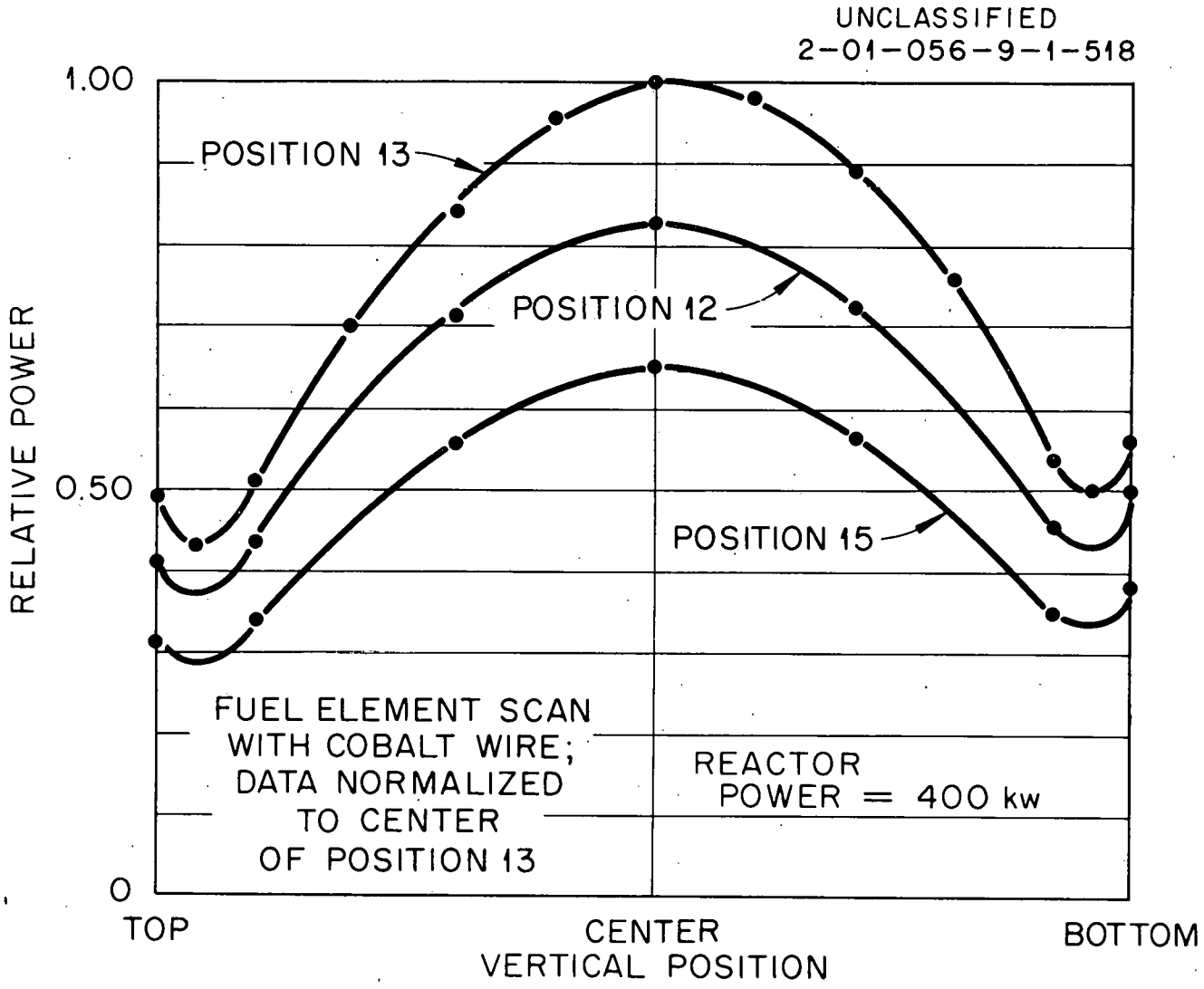

Fig. 2. TSR Vertical Power Distribution.

Table 1. Relative Thermal-Neutron Flux Distribution in Loading No. 4 of the Tower Shielding Facility Reactor

Measurements Made with Cobalt Wires

Distance from Top of Fuel Element (in.)	Relative Thermal-Neutron Flux Normalized to Center of Fuel Element in Position 13		
	Lattice Pos. 13	Lattice Pos. 12	Lattice Pos. 15
0.00	0.489	0.410	0.311
2.40	0.512	0.433	0.340
4.80	0.696	-	-
7.20	0.838	0.712	0.555
9.60	0.960	-	-
12.00	1.000	0.827	0.651
14.40	0.981	-	-
16.80	0.878	0.726	0.567
19.20	0.756	-	-
21.60	0.536	0.459	0.351
23.40	0.562	0.501	0.386
Average Flux	0.750	0.642	0.497
Average Flux Normalized to Ion Chamber Data for Lattice Pos 13	0.652	0.559	0.434
Ion Chamber Data	0.652	0.595	0.462
% Difference	-	-6.4	-6.5

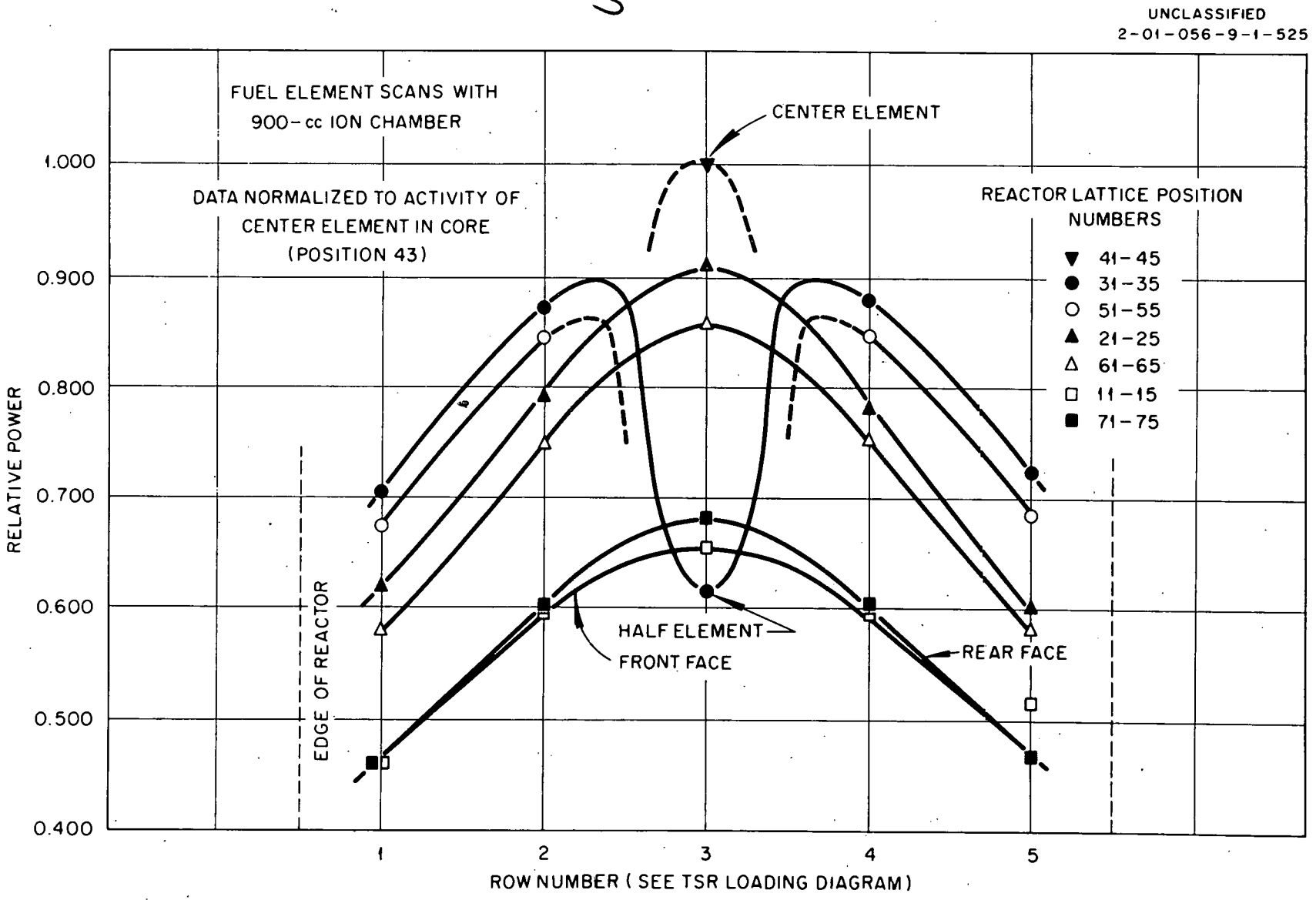

Fig. 3. TSR Front and Rear Face Power Distribution.

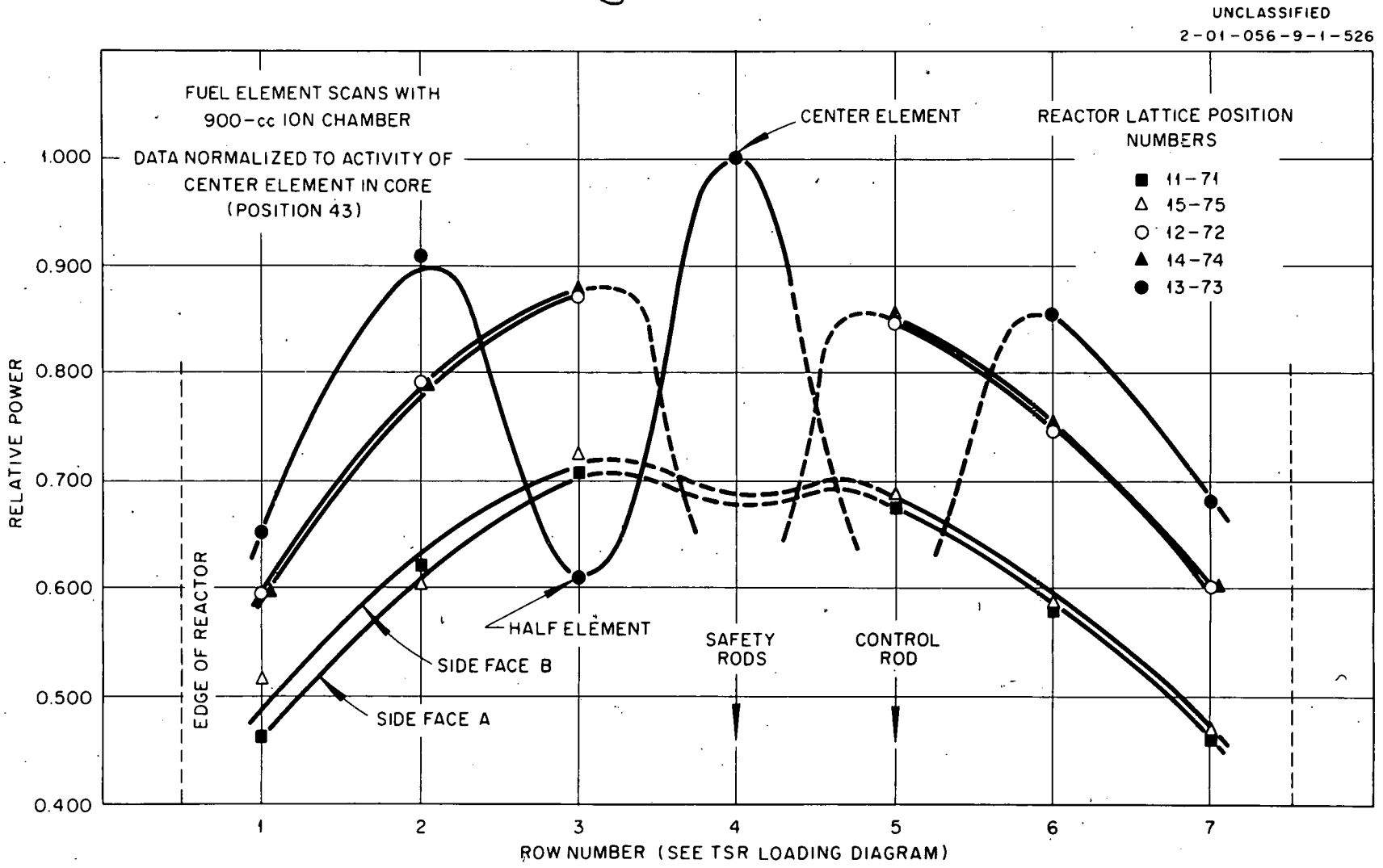

Fig. 4. TSR Side Face Power Distribution.

Table 2. After-Shutdown Fission-Product Gamma-Ray Activity in the Tower Shielding Facility Reactor

Measurements Made with 900-cc Ion Chamber

Reactor Lattice Position	Fuel Element No.	Total Uranium (g)	Total U^{235} (g)	Fractional Power Per Fuel Element	Gamma-Ray Activity Normalized to Core Center (Position 43)
11	T-25	150.296	140.005	0.0193	0.462
12	T-13	150.350	140.054	0.0250	0.595
13	T-26	150.276	139.986	0.0273	0.652
14	T-29	150.032	139.756	0.0250	0.595
15	T-28	150.036	139.758	0.0216	0.515
21	T-17	149.950	139.686	0.0259	0.618
22	T-8	150.549	140.252	0.0332	0.792
23	T-3	150.206	139.918	0.0382	0.910
24	T-14	150.050	139.778	0.0327	0.778
25	T-27	150.036	139.758	0.0252	0.601
31	T-18	149.968	139.695	0.0294	0.702
32	T-12	150.350	140.054	0.0365	0.871
33	T-32P	75.024	69.885	0.0257	0.612
34	T-15	150.075	139.801	0.0367	0.876
35	T-10	150.350	140.054	0.0304	0.724
41	None	-	-	0.0283	0.675
42	T-34C	75.141	69.993	0.0252	0.600
43	T-19	149.924	139.654	0.0419	1.000
44	T-35C	75.141	69.993	0.0252	0.600
45	None	-	-	0.0288	0.686
51	T-6	150.654	140.342	0.0283	0.674
52	T-23	150.356	140.062	0.0355	0.848
53	T-36 CS	75.046	69.903	0.0252	0.600
54	T-24	150.356	140.062	0.0355	0.848
55	T-11	150.350	140.054	0.0288	0.685
61	T-5	150.654	140.342	0.0242	0.579
62	T-2	150.310	140.014	0.0313	0.747
63	T-9	150.635	140.324	0.0360	0.859
64	T-20	149.924	139.654	0.0315	0.753
65	T-16	149.950	139.686	0.0245	0.584
71	T-1	150.427	140.186	0.0193	0.461
72	T-4	150.205	139.917	0.0252	0.601
73	T-22	150.174	139.887	0.0285	0.680
74	T-21	150.286	139.990	0.0252	0.601
75	T-7	150.507	140.202	0.0195	0.465
Total		4,657.588	4,338.705	1.0000	-

		Fractional Power
Front Face	-	0.118
Rear Face	-	0.118
Side Face A	-	0.175
Side Face B	-	0.179
Total from faces	-	0.590