MASTER **Westinghouse***Date* February 27, 1962*From* L. O. Ricks*TO:* Dr. S. Krasik
Dr. W. H. Esselman
Mr. F. D. Retallick
Mr. H. F. Faught
Dr. J. D. Clement*Subject* Equivalent Engine Radiation
Sources**REFERENCE**

The attached memo gives the equivalent point radiation sources for a Phoebus and NERVA engine. This data was prepared at Aerojet's request (AGC ltr 731:000:083 dtd 2-7-62 W. C. House to Dr. S. Krasik) for use by Bechtel Corporation in the preliminary design of the RIFT Stage Static Test Facility.

It is my understanding (telecom L. Ricks to A. H. Flagg, 2-16-62) that AGC will transmit additional radiation data that they originate to WANL for our review and concurrence.

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Date February 27, 1962

From L. O. Ricks, Reactor Analysis

Subject Equivalent Engine Radiation Sources

Attached are tables giving the equivalent point source strengths for radiations from an operating and a shutdown engine and a graph showing the change in the shutdown source with time. This data was compiled in response to Aerojet-General Corporation's request of February 7, 1962 (Ltr 731:000:083 W. C. House to S. Krasik), and is to be used in the preliminary design of the RIFT Stage Static Test Facility.

It should be noted that a point source does not accurately describe the radiation pattern closer to the core. The iso-flux lines close to the reactor (less than 20 ft.) are clover shaped in the vertical plane rather than circular as would result from a point. The values used to obtain the equivalent point source represent the maximum values of the lobes for each radiation.

The gamma sources during operation were obtained by reducing the flux values at 20 ft. where the iso-flux line began to approach a circle. The fluxes were obtained from shielding program 14-0 using fission and decay gamma sources.

The neutron sources were obtained by reducing the outputs from WANDA, PIMG and CURE diffusion codes.

The values presented in the tables are for a Phoebus engine but may be reduced to NERVA values by multiplying by the ratio of the power of the two engines (0.28). No rule-of-thumb conversion is available for higher powers without knowledge of the geometry and power density of the extrapolated core.

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The shutdown sources were determined for 24 hours decay. The source strength for any gamma energy group at other than 24 hours may be obtained by multiplying by the normalizing factors or by ratioing from the graph.

L. O. Ricks

TABLE 2 SHUTDOWN

Neutron Point Source - None

Gamma Point Source

GROUP	AVERAGE PHOTON ENERGY (mev)	SOURCE STRENGTH (mev/sec) $\times 10^{-14}$	1/24	NORMALIZING FACTOR 1 day = 1		
				2.5	5.5	30 days
1	0.4	7.2	19	0.33	0.17	0.03
2	0.7	71.5	24	0.40	0.15	0.026
3	1.0	2.1	55	0.36	0.17	0.064
4	1.5	19.6	80	0.60	0.53	0.16
5	2.0	32.3	28	0.71	0.015	0.001
6	2.5	3.1	200	0.51	0.42	0.12
7	2.8	.058	4000	0.50	0.44	0.22
8	3.5	.062	4500	0.51	0.46	0.19

RADIATION SOURCES OF A PHOEBUS ENGINE

TABLE I OPERATION

Neutron Point Sources

GROUP	ENERGY RANGE	SOURCE STRENGTH - S_n (n/sec) $\times 10^{-19}$
1	10 - 0.82 Mev	3.1
2	821 - 5.5 Mev	5.0
3	5.5 kev - 1.86 Mev	4.0
4	less than 1.86 ev	7.3

Gamma Point Sources

GROUP	AVERAGE PHOTON ENERGY (Mev)	SOURCE STRENGTH - S_γ (mev/sec) $\times 10^{-18}$
1	0.4	2.6
2	0.7	10.4
3	1.0	8.9
4	1.5	8.0
5	2.0	6.6
6	2.5	5.6
7	2.8	5.9
8	3.5	10.0
9	4.5	4.7
10	5.5	1.7
11	6.5	.33
12	7.5	.13
13	9.0	.023

GAMMA ENERGY RELEASE RATE
(MEV/WATT - SECOND)