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INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

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TO: M. W. Rosenthal and E. S. Bettis

FROM: W. L. Carter

SUBJECT: Heat Generation in MSBR Fuel After Removal from the Reactor

The accompanying graph should be of interest to persons concerned with the after-heat problem for MSBR fuel. The figure shows the decay heat given up by fission products in the fuel as a function of time after draining from the reactor. Zero time is taken at the time of draining; the decay is then followed for 10,000 days (27.4 years).

Two cases have been treated for the MSBR operating as noted in the caption of Fig. 1:

Case 1 (upper curve) - Equilibrium concentrations of fission products with no sparging of Kr and Xe in the reactor.

Case 2 (lower curve) - Equilibrium concentrations of fission products with Kr and Xe sparged from the reactor on a 30-sec cycle.

It is of interest to observe the difference in heat generation rate between Case 1 and Case 2, particularly at times immediately following draining the MSBR. Heat generation rate in this period is important in the design of the cooling system for the drain tanks. Sparging the noble gases has the effect of decreasing the gross heat generation rate by as much as 30% as shown in the following tabulation:

Time	Watts/ft^3 Fuel		Difference in Heat Generation (%)
	Gross Amounts of Fission Products	Kr and Xe Sparged on 30-sec Cycle	
0	16.4×10^4	14.4×10^4	12.2
1 min	6.2×10^4	4.7×10^4	24.2
5 min	4.8×10^4	3.5×10^4	27.1
10 min	4.2×10^4	3.0×10^4	28.6
30 min	3.1×10^4	2.2×10^4	29.0
1 hr	2.5×10^4	1.8×10^4	28.0
2 hr	1.9×10^4	1.45×10^4	23.7
5 hr	1.35×10^4	1.08×10^4	20.0
1 day	0.699×10^4	0.656×10^4	6.1

These results are the combined efforts of Jack Watson and the writer. Concentrations were calculated for 273 fission product nuclides for the MSBR operating under equilibrium conditions. The heat generation of these fission products and their daughter products was then computed by CALDRON.

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Attachment

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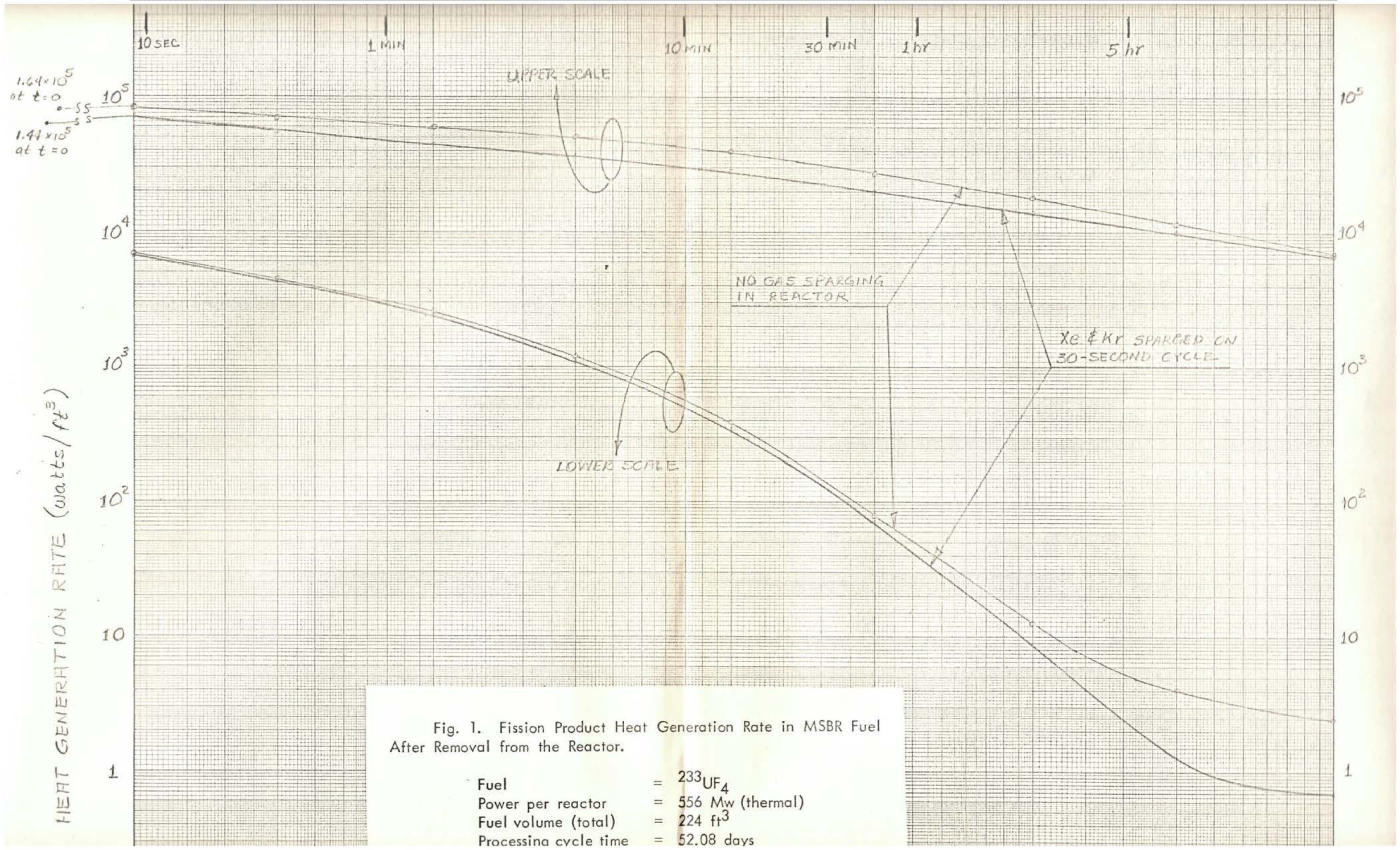

Fig. 1. Fission Product Heat Generation Rate in MSBR Fuel After Removal from the Reactor.

Fuel	=	$^{233}UF_4$
Power per reactor	=	556 Mw (thermal)
Fuel volume (total)	=	224 ft^3
Processing cycle time	=	52.08 days