Low-Enrichment Uranium-Metal Exponential Experiments

C. G. Chezem*
Los Alamos Scientific Laboratory, Los Alamos, N. M. 87544

and

R. G. Steinke**
Department of Nuclear Engineering,
University of Wisconsin
Madison, Wisconsin 53706

Received October 27, 1967

A study of low average enrichment, uranium-metal exponential columns has been performed at the Los Alamos Scientific Laboratory. The source reactor, materials, equipment, and procedures were essentially the same as used in the earlier natural-uranium experiment.1

Unreflected 21-in.-diam uranium cylinders of 6.53 and 9.12% 235U enrichment were investigated during the Summer of 1966.2 These efforts were extensions of work reported in 1965 on a 4.29%-enriched column.3 The enriched columns were formed by interleaving natural-uranium plates, machined from cast stock with uranium plates enriched to an average of 93.29% 235U, which were machined from rolled stock. The overall column density, allowing for stacking voids, was estimated to be 18.70 ± 0.05 g/cm².

Those results that are considered best values are tabulated on the preceding page.

Interpolation of a buckling vs percent-enrichment curve obtained from the above data by a quadratic, least squares analysis implies a 235U enrichment of (5.26 ± 0.11) % for infinite critical mass. Backscattering perturbations in the enriched assemblies were not as pronounced as in the natural-uranium system1 and were ignored.

ACKNOWLEDGMENTS

Work performed at the Los Alamos Scientific Laboratory under the auspices of the USAEC.

<table>
<thead>
<tr>
<th>Average Enrichment %</th>
<th>Length of Column (in.)</th>
<th>Method of Observation</th>
<th>(\bar{\alpha} (^{235}\text{U}))</th>
<th>(\bar{\alpha} (^{239}\text{Pu}))</th>
<th>(\bar{\alpha} (^{238}\text{U}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.12</td>
<td>25.28</td>
<td>Foil Activation (1)</td>
<td>0.0054 ± 0.0002</td>
<td>27 ± 1</td>
<td></td>
</tr>
<tr>
<td>6.53</td>
<td>32.72</td>
<td>Foil Activation (1)</td>
<td>0.0022 ± 0.0004</td>
<td>39 ± 2</td>
<td></td>
</tr>
<tr>
<td>4.29</td>
<td>31.4</td>
<td>Foil Activation (1)</td>
<td>-0.0018 ± 0.0003</td>
<td>57 ± 6</td>
<td></td>
</tr>
<tr>
<td>(0.72)</td>
<td>Chezem</td>
<td>Chezem</td>
<td>-0.0119 ± 0.0005</td>
<td>60.1 ± 3.0</td>
<td></td>
</tr>
</tbody>
</table>

*Corrects an arithmetic error in Table VI of Chezem.'