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AEC RESEARCH AND DEVELOPMENT REPORT

FINAL REPORT - PRODUCTION TEST 105-58-P

B PILE REACTIVITY UNDER SHUTDOWN CONDITIONS

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B PILE REACTIVITY UNDER SHUTDOWN CONDITIONS

Introduction

Following the shutdown of the B Pile in March 1946 a method was devised for monitoring the sub-critical reactivity such that any significant change in neutron flux would be detected. This report summarizes the status of the unit until its start up in July 1948.

Summary

Periodic measurements of the pile neutron flux were made by means of a standardized indium foil technique. The flux of the pile dropped off rapidly for about 100 days after which it became nearly constant until the subsequent start up in July 1948. The initial decrease in flux is attributed to the photoneutron reaction of fission product gamma on deuterium in the process tube water. The constant neutron flux remaining after the photoneutron effect is due to the spontaneous fission of the active metal in the unit. This activity was equivalent to a flux of about 106 neutrons/cm²/sec. with a gas purity of 100%. The pile was estimated to have had a multiplication factor of 1.5% below critical.

No significant changes in neutron flux were detected following the decay of the photoneutron reaction. The pile was shut down about 834 days.

A plot of neutron flux during the period of shutdown is shown in Figure 1.

Details

The specific procedure used in foil monitoring is described in detail in Document #7-4558, Interim Report, Production Test 105-58-P, "Reactivity of the B Pile Under Shutdown Conditions," by R. L. Menegus. The same document contains a discussion of the photoneutron component resulting from the decay of Ba¹⁴⁰ to lanthanum and the subsequent emission of a 2.34 Mev gamma. The latter reacts with the deuterium in the process tube water to produce the photoneutron reaction. This process decays with a half life of 12.5 days. This document also presents the calculations used to relate the neutron flux value to the percent by which the pile remained sub-critical.

Foil monitoring was discontinued after the pile had been shut down about 400 days. Just prior to recharging and poison tube changes in preparation for the July 1948 start-up, a final foil test was made. Although a slightly greater flux was found than in former tests, the magnitude of the change was such as to be little greater than foil test variations.

Some irregularities in flux measurements occurred. Gas purity could not in itself satisfactorily explain these variations. It was found that a correction of 1 ih/% air in the pile would bring points into line more satisfactorily with high percentages of air in the pile than the 2 ih/% air correction that is in current use. Figure 1 has not been corrected for gas purity due to the uncertainty of its magnitude and because the great majority of tests were made at very high helium percentages.

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Table 1 gives a summary of foil data after the decay of the photoneutron component.

TABLE I

B Shutdown Foil Data

<u>Date</u>	<u>Neutrons/cm²/second</u>	<u>Gas Purity % Helium</u>
6/18/46	101.1	42
8/8/46	103.8	88
8/22/46	106.1	90
11/29/46	107.0	99.1
12/17/46	105.2	98.9
1/9/47	103.1	99.1
2/12/47	106.5	99.2
3/12/47	105.0	99.2
4/9/47	103.3	98.9
6/19/47	110.0	87

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Figure 1

Days After Pile Shutdown

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