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NO. 6 OF 6 COPIES, SERIES A

Major General L. R. Groves
P. O. Box 2610
Washington, D. C.

Classification changed 2/9/49 by Authority of the U. S. Atomic Energy Commission

See memo dated 1-5-49 to Newburger from Gingrich assigning Copy No. 6A. It should be noted that there is a question on this copy number.

Dear General Groves:

S. Newburger, Jr. (RB)

1. We have recently investigated the dependance of the spontaneous fission of samples of plutonium on the extent of the neutron radiation to which they have been subjected. Samples have been investigated whose neutron radiation has varied over a range of 50. The fission rate of the sample appears to be proportional to the number of neutrons which have previously passed over the material. This strongly suggests that there is an ingredient in the samples formed by the neutrons, and responsible for the fission. We have investigated samples in which the fission rate corresponds to a neutron emission respectively equal to 1/5, 7/8 and 10 times that regarded as permissible in setting up chemical specifications of the purity of the product. Extrapolation of these results to Hanford product would indicate a neutron emission of several hundred times that permitted in setting up the chemical specifications.

2. It is known that when thermal neutrons pass through plutonium about 1 in 3 of the neutrons captured leads to the formation of the isotope 94-240, which has as the code name 410. This isotope does not decay by alpha emission of short life to form 26; and all efforts to find decay leading to element 95 or 96 have given negative results. Although further work will be done both by physical and chemical means to establish the stability of 410, there is an overwhelming presumption at the present time that it is for practical purposes stable. It is natural to ascribe the spontaneous fission observed in irradiated samples of plutonium to the presence of this isotope. The half life of 410 for spontaneous fission would then be of the order of 10^{11} years.

3. In view of the extreme unlikelihood in separating the source of the spontaneous fission from plutonium by chemical means, we have investigated briefly the possibility of an electromagnetic separation. The principal difficulties lie in the need for a decontamination by a factor between 100 and 1000 from the material differing by one unit in mass, and above all in the problems of chemical processing of so toxic a material, and in the absence of stand-ins. It is our opinion that this method is in principle a possible one but that the necessary developments involved are in no way compatible with present ideas of schedule.

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4. The number of neutrons per spontaneous fission of 410 has not been measured. We believe that we have sufficient experience in closely related phenomena to exclude the possibility that this number is so low as to alter the arguments given above. It will be some time before this number can be checked experimentally.

5. Although methods of assembly based on the avoidance of predetonation can probably accept somewhat less strict specifications than those originally set to determine purity, the margin is not a very wide one. At the present time plutonium has been purified to such an extent that the neutrons from chemical impurities are few compared to those to be expected from the spontaneous fission of 410 at Hanford concentrations. In the light of the above facts, it appears reasonable to discontinue the intensive effort to achieve higher purity for plutonium and to concentrate attention on methods of assembly which do not require a low neutron background for their success. At the present time the method to which an over-riding priority must be assigned is the method of implosion.

6. Since the results outlined above are new and since there is a possibility that the interpretation placed on them may not be completely correct, it was agreed in our discussion that although the discontinuance of the purification and neutron-less assembly programs should be started immediately, it should be so conducted that at any time within the next month a return to these programs can be made without loss of more than a month's time. In particular, no essential personnel or installations should be permanently lost to the project within that period.

Sincerely yours,

J. R. Oppenheimer

cc: A. H. Compton
C. A. Thomas
J. B. Conant