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John C. Bugher, M.D., Director   April 12, 1954
Division of Biology and Medicine
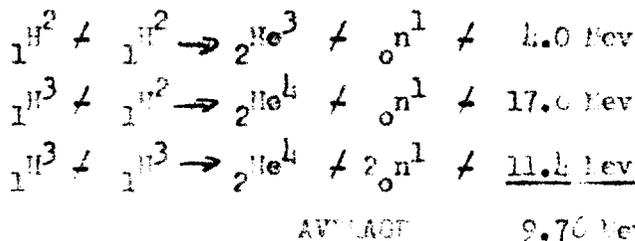
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SUMMARY OF UNCLASSIFIED CALCULATIONS ON PRODUCTION OF COBALT-60
IN FUSION DEVICES

1. Assuming the production of one neutron per 10 mev of energy
    release*, a 1-megaton bomb would produce 2.5×10^{27} neutrons.

2. If every neutron were to be captured by a Co^{59} nucleus, it
    would require 2.5×10^{5} grams (about 550 lbs.) of Co^{59} or a
    volume of one cubic foot.

3. In view of the low cross section of Co^{59} and the attenuation of
    Co^{59} as a result of the explosion, it is assumed that less than
    0.1% of the neutrons released would be absorbed in Co^{59}.

4. If one arbitrarily selects 0.1% as the percentage of neutrons
    produced that will react with a Co^{59} nucleus, a 1-megaton
    fusion device would produce 2.7×10^{5} curies of Co^{60}. Assum-
    ing that 25% of this activity fell out in 5,000 square miles
    around ground zero, the initial dose rate from Co^{60} would be
    about 0.15 mr/hr. This would be insignificant compared to the
    radiation dose rate from the fission products from a nuclear
    weapon for many months after detonation.

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* Some possible reactions are:

$$_1H^2 + {}_1H^2 \rightarrow {}_2He^3 + {}_0n^1 + 4.0\ \text{Mev}$$

$$_1H^3 + {}_1H^2 \rightarrow {}_2He^4 + {}_0n^1 + 17.6\ \text{Mev}$$

$$_1H^3 + {}_1H^3 \rightarrow {}_2He^4 + 2{}_0n^1 + \underline{11.4\ \text{Mev}}$$

AVERAGE   9.76 Mev

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