

UNIVERSITY OF CALIFORNIA
LOS ALAMOS SCIENTIFIC LABORATORY
(CONTRACT W-7405-ENG-36)
P. O. Box 1663
Los Alamos, New Mexico 87544

IN REPLY
REFER TO: MP-3

November 5, 1973

mes-200

Dr. Frank M. Waterman
Smith Laboratory of Physics
Kent State University
Kent, OH 44242

Dear Dr. Waterman:

In response to your question about the source of the value of approximately 0.75×10^{-6} rad/(π^- stop/cm³), I've outlined below how this was obtained. Only the energy deposited in the "vicinity" of the pion star is considered to contribute to the dose. This energy, by my definition, comprises both the energy deposited by the charged particles emitted in the star process arising from π^- absorption by ¹⁶O and the kinetic energy of a pion with one centimeter residual range. These two quantities are:

1. Kinetic energy of charged particles emitted in the star process = 49 MeV (see "Calculation of the Capture of Negative Pions in Light Elements and Comparison with Experiments Pertaining to Cancer Radiotherapy," Guthrie, et al., ORNL-TM-2371-R).
2. Kinetic energy of a π^- with one centimeter residual range = 12 MeV

The total = 61 MeV/(π^- stop) (in the "vicinity" of a stopped pion) = 78 erg/(π^- stop) or an equivalent dose of $\approx 0.75 \times 10^{-6}$ rad/(π^- stop/cm³). This value does not include an estimate of the contribution from star neutrons.

Of course, in a large volume being irradiated by pions, the dose in any particular locality is generally a combination of not only the dose deposited by stars and the nearby dE/dX dose accompanying the star but also the dE/dX dose deposited by higher energy pions passing through the locality to stop at a deeper depth in tissue. The relative contribution of this dE/dX dose depends strongly on the energy distribution of the incident beam and on the locality of interest so must be calculated for each particular case.

0.7
2.5
11/6/73

REPOSITORY L.A.N.L./RC
COLLECTION Div. Off. Files
BOX No. B-11, D-88
FOLDER MES 200 7/73



COPIED FOR
HSPT

1084673

AN EQUAL OPPORTUNITY EMPLOYER

00133046.001

Mr. Frank M. Waterman

November 5, 1975

I hope this information is useful. If there are further questions please let me know.

Sincerely,

Richard Hutson

Richard L. Hutson

RLH:ls

**COPIED FOR
HSPT**

1084674

00133046.002