March 16, 1967

Mr. W. L. Beck
Oak Ridge Institute of
Nuclear Studies
P. O. Box 117
Oak Ridge, Tennessee 37830

Dear Mr. Beck:

Enclosed are some of the preliminary calculations which I made upon returning to Cincinnati from the conference there in Oak Ridge. In going through the calculations, I found that I had used a u = .03 cm^{-1}. So I have done the following to come up with an average dose. I followed pretty much what was done in the School of Aviation Medicine, USAF, Report No. 57-70 done by Warren Sinclair and Art Cole. Figure 1 is the relative dose as a function of depth for the larger focal skin distance which we used in our total body irradiation procedure. This data is replotted on semi-log in Figure 2, from which we would get a u = .046 cm^{-1}. This u corrected for distance, which is also shown on Figure 2, gives us a final u of .039 cm^{-1}. From Table 1, in which the first two columns are taken from Mayneord's article in the British Journal of Radiology, and for a u of .039 cm^{-1}, we get corresponding lateral dimensions shown in the right column. These are plotted for trunk and for limbs (assuming limbs to be 21/40 of the lateral dimension of the trunk) in Figure 3. Taking as Sinclair did in the article, 4/7 of the trunk value and 3/7 of the limb value, we have obtained the whole body value shown in Figure 3. That is the average dose over the skin dose as a function of lateral dimension for whole body for a u equal to .039 cm^{-1}. Figure 4 gives the skin dose in roentgens as a function of the lateral dimension in centimeters. Having the average dose divided by the skin dose and the skin dose, we then get Figure 5 which shows the average dose in rad per 100 roentgen in air at midline as a function of lateral dimension. The transition from Fig. 3 to Fig. 5 (with the help of skin dose values given in Fig. 4) also considers a factor of .935 (taken from Mayneord's article) to correct for fact that our data is for an average focal skin distance of 267 cm., whereas data derived from Mayneord's values are for infinite focal skin distance. The average dose in rad per 100 roentgen in air at midline has been determined in this manner for the patients in the total body irradiation project. These are shown in the next to last column of the long table included in this letter. It would be of interest to compare these to the actual experimental measurements which you made to see how

close they are for the different sized patients. If there is still an appreciable difference and because of the fact that what I have done here is somewhat theoretical and based on some assumptions, that the actual experimental value determined for different sized cylinders would perhaps be the more accurate value to take. I would therefore be interested in obtaining a table containing these average dose values for the different sized patients from your data. You will also notice in the long table that the patients with numbers less than 25 have had an adjustment made to their midline absorbed dose in rads and in the surface exposure in roentgens. This is because in the first few patients the four or five percent backscatter factor was inadvertently omitted. The values given for surface exposure in roentgens and midline absorbed dose in rads given on the long table are therefore the correct values.

I will look forward to hearing from you.

Sincerely,

James G. Kereiakes, Ph.D.

JGK/sjt

Enclosures