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August 16, 1962

Dr. J. S. Robertson
Brookhaven National Laboratory
Associated Universities, Inc.
Upton, Long Island, New York

Reference: Conference on Neutron Capture Therapy
Invitation Letter from Dr. C. L. Dunham, Director,
Division of Biology and Medicine, Atomic Energy Commission

Dear Dr. Robertson:

In cooperation with the Atomic Energy Commission and in concurrence with Dr. Dunham's letter of August 6th, the American Institute of Biological Sciences is pleased to inform you that final arrangements have been made for the above conference. It is our understanding that a tentative agenda and other pertinent information have already been forwarded to you.

As you know, the conference will be held in Washington, D. C. on September 24th and 25th. A meeting room has been reserved at the Windsor Park Hotel which is conveniently located at 2300 Connecticut Avenue. For your convenience, tentative hotel accommodations have been reserved for you the nights of September 23rd and 24th. Your confirmation of these arrangements will be appreciated.

We sincerely hope that it will be possible for you to participate in this important conference.

An early reply will be appreciated.

Sincerely yours,

Helene Abell

(Mrs.) Helene Abell
Special Projects Department

HA:jd

Confirmed arrangements on 8/20/62 J.

March 25, 1963

File

R. Fairchild

Modification of MRR Animal Port

The Animal Port has been modified to give a beam of epithermal neutrons with a penetration curve (Ø vs distance) in a tissue-equivalent phant head (TEPH) suitable for N.C.T. The modification was made in the Animal Port rather than the Patient Port, since it is anticipated that experimental animal irradiations will be carried out. Also, expected irradiations of tissue-equivalent chambers and threshold detectors in the epithermal beam at various D_2O thicknesses would give a needless exposure to the reactor operators if carried out at the Patient Port.

The thermal flux, Cd ratios, γ contamination and neutron penetrations in a Cd-wrapped TEPH were evaluated at the Animal Port for the case of 7.075" D_2O and 0" D_2O in the reflecter. These results agreed within 4% with the corresponding results at the Animal Port. Therefore, the two facilities can be considered identical. A 60-mil Cd filter was installed in the Animal Port, since satisfactory neutron penetrations in a Cd-wrapped TEPH have been obtained at the Patient Port (BNM 6824). However, a 4'x4' filter was installed between the 3.375" D_2O tank and the 3" Bi filter in the reflector (Fig. 1) rather than at the point of irradiation for two reasons: 1) Cd cannot be used at the point of irradiation since it is a significant source of capture γ's, and 2) it is desirable to remove the thermal neutron component as close to the core as possible since the γ contamination resulting from the capture of thermal neutrons in the structural material will be reduced as much as possible.

The penetration curve resulting with the 4'x4' filter in place is shown in Fig. 2. All data described below were taken with 7.075" D_2O in the shutter. The Ø intensity in Fig. 2 is higher than that obtained with the same filter at the point of irradiation. The peak to surface ratio of 1.38 shows the presence of thermal neutrons in the incident beam. (A peak to surface ratio of 4.1 is obtainable with the filter at the point of irradiation.)

The 2" polyethylene reflector was removed from the shutter, since in reflecting neutrons back into the beam it also degrades their energy. The resulting penetration curve is shown in Fig. 3. An improvement in the peak to surface to 2.2 was observed, showing a significant reduction in the thermal neutrons. It is interesting to note that from 5 cm on out, the Ø intensity is greater than that shown in the curve with the polyethylene in. Cadmium ratio measurements indicate an increase in the epithermal component. It is perhaps possible that the boral and Fe remaining in the shutter scatter a significant number of epithermal and fast neutrons back into the beam without degrading their energy.

Since the peak-to-surface ratio of 2.2 still indicated a contaminating thermal neutron flux, a 1-mm-thick piece of enriched Li^6 metal was used to cover the front of the phantom head. Thus the remaining thermal neutrons would be removed at the point of irradiation regardless of their origin without a significant release of γ's. The curve thus obtained is shown in Fig. 4. The peak-to-surface ratio improved to 3.38. This ratio of 3.38 is probably as high as can be obtained with this geometry using a 1/v absorber at the point of irradiation. The peak intensity is 2.8% lower than that obtained with a single Cd filter at the point of irradiation. Thus the two-filter system just described produces a penetration curve similar in shape and intensity to that obtained under "optimal conditions" (single Cd filter at the point of irradiation).

The γ contamination at the bare port face with the two-filter arrangement that gave the curve in Fig. 4 is 8 r/min at 1 MW as measured with a Carbon-CO_2 current flow chamber. Gamma measurements were also made with a Victoree, Landsverk and Baldwin Farmer B.D. 11 and B.D. 2/15 chambers. These chambers gave γ dose rates of 18, 15.6, 16 and 19.5 r/min, respectively. They all, however, suffer from a neutron sensitivity due to the H_2 and N_2 in their air filling. Therefore, it is assumed that the 8 r/min given by the C-CO_2 chamber represents the most accurate estimate of the γ contamination. A condenser C-CO_2 chamber is being made so that an independent check can be made.

Assuming the γ contamination is 8 r/min at 1 MW and using the peak flux from Fig. 4, an integrated neutron flux of 5×10^{12} n/cm^2 could be delivered in 6 min (reactor power 5 MW) with an associated γ dose of 240 r (the 240 r does not include the γ dose from neutron capture in tissue). This is less of a γ dose than would have been delivered by the reactor γ contamination in a 120-sec run with a thermal beam at 5 MW. An additional advantage will obviously be gained from the removal of the thermal neutrons which were previously incident on the surface tissue. It should be remembered that the use of any beam-defining devices will reduce the neutron flux and lengthen the irradiation time. The γ dose rate does not increase with time during a 6-min run at 5 MW. Residual activity at the bare port face after a 6-min run at 5 min is 75 mr/hr.

The absorbed dose from fast neutrons remains to be determined. Preliminary data indicate a significant dose in rads at D_2O thicknesses less than 7.075". Therefore, the above data were taken with all the D_2O (7.075") in the shutter. Dog irradiations, etc. could be carried out while the fast neutron flux is being evaluated in order to gain experience with any beam-defining devices used, and to evaluate the biological effect of the epithermal beam.