## DEPARTMENT OF RADIATION ONCOLOGY

CAMDEN-CLARK MEMORIAL HOSPITAL 800 GARFIELD AVENUE P.O. BOX 718 PARKERSBURG, WEST VIRGINIA 26102 TELEPHONE 304/424-2744

CHANDRA S. SEKAR, M.D. Radiation Oncologist SRINI VASAN, M.D. Radiation Oncologist MUKUND K. KARTHA, Ph.D. Medical Physicist

February 19, 1985

Ms. Patricia J. Whiston Material Licensing Section U.S. NRC Region III 799 Roosevelt Road Glen Ellyn, Illinois 60137

Dear Ms. Whiston;

## Reference: Control Number 77608

This has reference to your letter of February 7, 1985, regarding the "unusually high level of exposure rate" in room 115, above the telecobalt room at Scioto Memorial Hospital, Portsmouth, Ohio. I have been their Medical Physics consultant for radiation therapy over 10 years and have made complete leakage and exposure rate measurements in and around the telecobalt room after new sources were installed in 1979 and in 1984. As at the previous occasion, in my September 7, 1985 measurements also, the exposure rate in a very small area of the visiting room above the teletherapy installation showed a 1.6 mrem maximum exposure for the worst of conditions of the C-arm angle, head tilt and angulation and largest possible field size. This situation was created to comply with the U.S. NRC requirements of having to measure exposure rates in the worst of situations. This however, is not a combination of machine setup ever used in clinical radiation therapy.

Even if there exists a remote possibility of using this complex setup combination in patient treatment, one has to use the weekly work load "W", use factor "U" and occupancy factor "T" in the final estimation of optimum exposure condition (Refer to NCRP Handbook Number 49).

Scioto Memorial Hospital treats less than 200 patients annually, which translates to a daily patient load of 20. Almost all radiation oncology patients in the U.S.A. today is treated five days-a-week ONLY. The average tumor dose to these patients is 200 rad at mid-depth of their body being treated, which averages to 55% depth dose. This means the weekly work load would be

 $W = (200 \div 0.55) \times 20 \times 5 \times (80 \div 100)^2 = 23,273 \text{ rad/week at 1 meter.}$ 

This would calculate to less than 1,400,000 RHM. For telecobalt sources with initial strength of 3,500 RHM and changed every 5 years, the average 1885 ON time would be about 10 hours, with maximum and minimum beam ON times of 13 and 7 hours respectively.

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8503220302 850301 RE03 LIC30 34-15938-01 PDR For 20 patients treated daily, the average number of fields treated each day would be 2, for a total of 40 fields treated daily. On the average 2/3 to 3/4 of these fields are typically vertical fields (i.e. C-arm angles 0° and 180°), and at least 90% of the fields are 15cm x 15cm or smaller. The maximum field size of 36cm x 36cm is used in less than 5% of cases treated and such fields are almost always directed at C-arm angles of 0° and 180°. The only horizontal field directions, involving large sizes would be irradiation of legs, where long and narrow fields are used in horizontal directions (i.e. C-arm angles of 90° and 270°). Such fields may be as much as 20cm x 36cm, used at 0° head angle and tilt.

Assuming all 0.5% of these large fields are treated in the worst possible c-arm angle, head angle-tilt combination, as in the case for which the high dose rates of 1.6 mR/hr and 0.7 mR/hour average were measured in room 115, the weekly cumulative dose, for a full occupancy (7 - 1) in room 115 would be:

1.6mR/hrx(13 hrsx0.005) or 0.1 mrem per week.

and 1.6mR/hrx(13 hrsx0.005) hr/weekx52 weeks/year = 5.4mrem/year.

For arguments sake, let us consider all this worst situation treatments are given in one weeks time over the year's period, the total radiation level in any one hour would NOT exceed 2 mrem in any ONE HOUR and would be less than 10 mrem in any seven consecutive days, as required by Section 20.105(a) of 10 CFR Part 20.

Room 115 in question has an occupancy of 1/4 and NOT 1 as we have considered in the preceeding. This would lower the maximum estimated exposure to any hospital visitor spending time in room 115 to be well below the exposure he or she would receive visiting the ski slopes of Colorado one week a year.

I am confident that this detailed explanation answers your question regarding the high exposure level we have encountered in the radiation survey of the teletherapy room at Scioto Memorial Hospital, and help you proceed with the review of the application for renewal of the teletherapy license Number 34-15938-01.

If you have any further questions regarding this teletherapy license renewal application, please feel free to contact me at (304) 424-2744 Mondays through Thursdays.

Sincerely

Jankend KKarty PhD

Mukund K. Kartha, Ph.D. Medical Physics Consultant

- cc: 1) John D. Rowson, R.T. Radiology Adminstrator
  - George V. Johnson, M.D. Radiologist Scioto Memorial Hospital Porstmouth, Ohio 45662

TIME DATE CONVERSATION RECORD TYPE ROUTING CONFERENCE TELEPHONE T VISIT NAME/SYMBOL INT INCOMING OUTGOING Location of Visit/Conference: NAME OF PERSON(S) CONTACTED OR IN CONTACT ORGANIZATION (Office, dept., bureau, TELEPHONE NO. WITH YOU etc.) SUBJECT SUMMARY all concerning controls on unrestricted area ( Room 115 20 limits for road level Par prestricted area? = 1.6 mR/ SM may Hom O.7 mR/Sh ava. fuebt of Mr. Dowan - send letter neques ACTION REQUIRED NAME OF PERSON DOCUMENTING CONVERSATION SIGNATURE DATE ACTION TAKEN SIGNATURE TITLE DATE OPTIONAL FORM 271 (12-76) DEPARTMENT OF DEFENSE 50271-101 CONVERSATION RECORD # GPO : 19m. 0 - 361-526 (7227)

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