MASSACHUSETTS INSTITUTE OF TECHNOLOGY
MEDICAL DEPARTMENT
ENVIRONMENTAL MEDICAL SERVICE

77 MASSACHUSETTS AVENUE, 20B-238
CAMBRIDGE, MASSACHUSETTS 02139

March 24, 1988

US Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia PA 19406

Attention: Ms. Betsy Ulrich

Dear Ms. Ulrich:

This letter is to follow up on our letters of December 3, 1987, and February 9, 1988, concerning the apparent extremity overexposure of one of our radiochemists, completing our assessment of this exposure, attempting to correct further apparent discrepancies in dosimeter readings on this individual. As indicated previously, we have been concerned that the wrist badge reading has routinely been overestimating the wrist exposure based on the positioning of this badge during the postmortem exposure period on the Ho-166 animal experiments, and based on the much lower finger dosimeter readings in all circumstances. We have now performed direct dose rate comparison measurements under conditions designed to closely simulate the conditions present during the postmortem and find that the actual dose rate to the wrist surface has been overestimated by the wrist badge by approximately 33% for the exposure received during this part of the operation due solely to geometry considerations. We therefore propose that the actual exposure to the wrist should be adjusted as follows:

1. The September wrist exposure must first be subdivided between that received in the ongoing dysprosium studies and the new holmium studies. Based on earlier experience, we believe 2000 mRem of the September wrist exposure to be a reasonable estimate of the September wrist exposure from dysprosium.

2. Deducting the above 2000 mRem from the 15040 mRem September wrist exposure leaves 13040 mRem due to holmium. Reducing this number by 1/3 for the geometry correction determined above results in a deduction of 4303 from the total, leaving a quarterly wrist exposure of 18606 mRem.

3. This compares favorably with the right ring reading of 11500 for the quarter, for which we believe no geometry correction is necessary, and results in a consistant ring/wrist ratio throughout which we believe to be credible.

In assessing this entire episode, it is important to emphasize and recognize the two distinctly separable operations being performed by this one individual. The older dysprosium study involves the routine processing of some 80 curies of dysprosium each month for clinical trials elsewhere. This

work had been ongoing for several months prior to this incident with wrist exposures ranging from 1800 to 5000 mRem per month, depending on the number of shipments processed. Since this work schedule was finite in nature, subject to month-to-month review on its continuation, we considered it reasonable to allow continuation of this exposure for several months until a long-range projection became available. The long-range projection of the indefinite continuation of this effort became available at approximately the same time the exposure difficulties with holmium came to light and reconsideration of this work was undertaken with both issues in mind. Since October we have added a second radiochemist to the project and improved the dysprosium handling techniques to reduce both individual and collective exposures in what we now know will be a long-term project involving the routine processing of dysprosium.

The holmium project, which reached full pace in September, both in terms of activity handled and the high-dose animal work, was suspended as soon as possible after it became known that it was responsible for extremity exposure above anticipation. While considerable thought has gone into proper shielding and handling techniques for the resumption of this project, it has not been reinstated at this time, and will only be resumed when it is clear that past problems are fully addressed to our satisfaction and monitoring frequencies are increased to provide adequate warning of impending difficulties.

This entire episode brings up the question of the application and interpretation of ALARA for difficult tasks such as these. I believe that the ALARA concept is an issue where meanings change with circumstances best controlled and understood by those closest to them. In the case of the dysoprosium processing, we felt it reasonable to allow exposure of up to 50% of extremity limits for a period of months since we knew that the whole body exposures were low and with the understanding that the procedures would be reevaluated if they were to be extended beyond a few months. That reevaluation was scheduled and would have taken place whether or not the higher holmium exposures complicated the issue.

Comparison of ALARA application and effect between institutions is difficult at best, but is probably not justified unless comparable circumstances exist at both institutions. (e.g. compare two circumstances where 80 curies per month is in process temporarily).

I trust this helps to clarify our thinking in this matter. Please feel free to contact me at (617) 245-6600 if further information is required.

Yours truly,

F.X. Massé
Director Radiation Protection

FXM/nlj