DEPARTMENT OF VETERANS AFFAIRS
Medical Center
Iowa City IA 52246-2208

MAR 0 2 1999

In Reply Refer To: 584/115

U.S. Nuclear Regulatory Commission, Region III
801 Warrenville Rd.
Lisle, IL 60532-4351

Thru:
Milton Gross, M.D., Program Director
Nuclear Medicine Service, Diagnostic and Radiation Safety Services, SHG
2215 Fulier Road
Ann Arbor, MI 48105

The purpose of this letter is to provide an amended report regarding two incidents involving the administration of Sn-117m to patients in our Nuclear Medicine Section. A more substantive inquiry has been made since the original report and the results are enclosed.

Please note the last sentence of the report and that we have received guidance from the VA National Health Physics Program regarding these matters. If you have interpretive differences, please advise the national program.

If you have any questions or require additional information, contact the Radiation Safety Officer, William Pettit, Ph.D., at 319-338-0581, ext. 6030.

Gary L. Wilkinson
GARY L. WILKINSON
Medical Center Director

Enclosures

AMENDED REPORT OF SN-117M PATIENT INCIDENTS

This report of two incidents with Sn-117m patients is amended to reflect information that had been forthcoming subsequent to the initial report, specifically that during the initial investigation it was not discovered that the first patient, case A, was hospitalized following injection and that an initial assumption regarding interpretation of the regulations has been revised. We wish to rescind the initial report.

CASE A

A patient that received 40.29 mCi of Sn-117m DTPA on 5/13/99 was hospitalized as an in-patient at the time of administration of the material, but no precautions or instructions for staff were provided. The RSO identified the violation during QMP review on 1/8/99. This patient remained at this facility in room 7E-30, a single patient room, for 7 days. One adjacent room was apparently intermittently occupied during his stay; the other was a family room for visiting family. On 5/20/99 he was transferred to Knoxville VA on 67D ward. He was discharged from that institution on 5/29/99 and went home where he lived alone with his wife. A total dose was calculated based on criteria in Regulatory Guide 8.39 and whole body clearance data*.

$$Dt = 34.6\ (1.48\ R/m\text{'}\ \text{-}\ hr)\ (0\ 224)\ (40.29\ mCi)\ (1.31\ day)^{*}\ (\ 0.25)\ /\ (100\ cm)^2\ +$$
$$34.6\ (\ 1.48\ R/mCi\text{-}hr)\ (0.776)\ (40.29\ mCi)\ (13.61\ day)\ (0.25)\ /\ (100\ cm)^2$$

$$= 0.015\ rem + 0.545\ rem = 0.560\ rem$$

This total dose was fractionated based upon the amount of time the patient spent at each facility and at home, using $e^{-\lambda t}$ to determine the fraction of the total exposure at each location. In addition, modification of occupancy factors based on the situation and standard care provided this type of patient (1 hour at an average distance of 1 meter per shift) were used.

At Iowa City:

Approximately 30% of the total exposure was delivered during the first 7 days.

An estimate of total exposure delivered to a patient occupying an adjacent room was estimated. This exposure assumes a patient occupied the adjacent for the entire time. A measurement of transmission of a Sn-117m source through a typical wall at this facility indicated a shielding factor of 2.3. Distances between beds in adjacent rooms were 2.5-3 meters.

For 24 hours/day and 7 days (occupancy factor of 1) the total exposure for a patient in an adjacent room was:

$Dt = 2.24\ rem^{\#}\ (0.3)\ /(2.5\ meter)^2\ (2.3) = 0.047\ rem$

*See Krishnamurthy, et.al., J. Nucl. Med. 38 (2), 230-237, 1997. The effective half-life for the rapid clearing component was derived using biological clearance data and the following equation: $T_{eff} = (T_{biol})(T_{phys}) / T_{biol} + T_{phys}$

Dt for occupancy factor of 1

For nursing staff an additional reduction of the occupancy factor in the original calculation above of 0.167 (1/6) was used based on 1 hour of care per shift.

0.560 rem (0.3)(0.167) = 0.028 rem (assumes 7 day work week)

At Knoxville:

The rapidly cleared component is not considered and approximately 26% of the total remaining exposure was delivered during the 9-day period. The rooms adjacent to the patient's room (a single) were not normally occupied (one was a mechanical room; one electrical)

For nursing staff, using the assumptions above:
0.545 rem (0.26)(0.167) = 0.023 rem (assumes 9 day work week)

The maximally exposed individual was the patient's wife. Her total exposure is the sum of her exposure resulting from hospital visits and at home following the patient's release.

Approximately 44% of the exposure was delivered after 16 days.

In an interview with the patient's wife, she indicated that she visited with the patient once at each facility for about 2 hours each visit. For Iowa City a factor of 0.012 (2hr/168 hr per 7 day) and for Knoxville of 0.0093 were used.

Iowa City visit: 0.560 rem (0.3)(0.0.012) = 0.002 rem

Knoxville visit: 0.545rem (0.26)(0.0093) = 0.001 rem

Further the wife indicated that she worked full time and that she and her husband had slept in separate rooms. The separate sleeping arrangements were considered to provide a mitigating factor of 0.67 and the work situation, a factor of 0.76 (see above).

Therefore:

At home: 0.545 rem (0.44)(0.67)(0.76) = 0.122

Total (at home and visits) = 0.122 rem + 0.002 + 0.001 = 0.125 rem

CASE B

In another case a patient was given 8.14 mCi of Sn-117m under the same protocol and subsequently released to home without being provided with precautionary instructions. In this instance total exposure was calculated in a manner similar to that above. The patient indicated that his wife worked for 40 hours per week and slept in the same room, but different beds. He had taken no long car trips since the study. A reduction factor of 0.76 in the dose to the wife based on her absence from the home during work was used in the calculation. No additional mitigation of the wife's dose was considered.

$$Dt = 34.6\ (1.48\ R/mCi\text{-}hr)\ (0.224)\ (8.14\ mCi)\ (1.31\ day)^{*}\ (0.25)(0.76)\ /\ (100\ cm)^2\ +$$
$$34.6\ (1.48\ R/mCi\text{-}hr)\ (0.776)\ (8.14\ mCi)\ (13\ 61\ day)\ (0.25)(0.76)\ /\ (100\ cm)^2$$

$$= 0.002\ rem + 0.084\ rem = 0.086\ rem$$

In both cases our assessment is that the exposures will cause no immediate health hazards and that the risk of any long-term health detriment is minimal.

Procedures have been implemented to prevent recurrence of this type of incident. No copies of this report have been sent to exposed individuals based on advice of the VA national Health Physics Program.