

Appendix E

Calculation of Dose to Researcher A's Hands

There are a variety of approaches to calculating possible dose to the Researcher A's hands, based on whether dose is calculated for reasonably expected levels of contamination on the hands or whether dose is calculated from a worst-case approach. Because Researcher A handled the source assembly directly with ungloved hands, we cannot rule out the possibility of significant levels of contamination resulting from handling the source assembly. As a worst-case approach, we will base our calculation on the highest level of contamination discovered during any aspect of our incident response, i.e., the activity found during the leak test of the damaged source after the collimator was removed.

Researcher A stated that he typically washes his hands each half-day while he is working in the lab and that in the course of a 24-hour day, he estimated that he washes his hands 3-4 times. As a result, we assume a residence time on his hands of four hours for any contamination. Our experience in the course of this incident is that the contamination is readily removable and because we found little or no contamination on objects outside of Location B, we will assume that each episode of hand washing removed hand contamination completely.

Contamination on leak test swab: 0.889 μCi

Assume that the contamination is distributed equally over the palmar surface of one hand. According to ICRP Publication 23, *Report of the Task Group on Reference Man*, the surface area of the outstretched palm and fingers is approximated as 1% of the surface area of the entire body. Since the surface area of the reference adult male is 18,000 cm^2 , we will estimate the palmar surface area to be 180 cm^2 .

As a result, the concentration of contamination on Researcher A's hand is estimated to be 0.889 μCi spread over 180 cm^2 or 0.005 $\mu\text{Ci}/\text{cm}^2$.

From the *Radionuclide and Radiation Protection Data Handbook 2002*, a publication of the International Commission on Radiological Units and Measurements, we find that the contamination skin dose for Sr-90/Y-90 is 3.51 mSv/hr per kBq/cm^2 , which is equivalent to 130 mrem/hr per $\mu\text{Ci}/\text{cm}^2$.

Assuming a palmar surface concentration of 0.005 $\mu\text{Ci}/\text{cm}^2$ and skin dose rate of 130 mrem/hr per $\mu\text{Ci}/\text{cm}^2$, the total dose is calculated to be **2.6 mrem** for an exposure period of four hours.