QUESTION 13

A technician at your university was performing a cell wash at a sink inside a walk-in cooler. Approximately 45 cm away, a protein labeled with ^{125}I was being dialyzed. The technician observed the radioactive material sign on the dialysis material, became concerned and contacted, the chairperson of the Radiation Safety Committee (RSC). Because she was performing a procedure that did not involve radioactive material, she was not wearing dosimetry. The chairperson has asked you to investigate.

You learn that the protein labeling procedure was conducted two weeks ago with 370 MBq of ^{125}I. The labeling procedure has an efficiency of 45%. The technician was present in the work area for about 1.5 hours while the protein was being dialyzed.

GIVEN

Half-life of ^{125}I = 60.1 days.
Lead density: 11.35 g/cm^3
Mass attenuation coefficient of lead: 28.9 cm^2/g.
Gamma constant (Γ) for ^{125}I : 7.4x10^{-5} mSv/hr-MBq @ 1 meter.
^{125}I emits the following:

Emission	Energy (keV)	Intensity (%)
x-ray	27.2	39.7
x-ray	27.4	74.1
x-ray	31	25.7
gamma	35.5	6.7

POINTS

10 A. List two possible routes of exposure to the technician and how you would assess each. **Number your responses. Only the first two will be graded.**

50 B. Assume attenuation from the dialysis apparatus is negligible and the apparatus is a point source. Calculate the effective dose from external radiation to the technician. **Show all work**.

20 C. The technician has some lead foil that is 0.015 cm thick. Assume that the activity of the source is 200 MBq for this part. What is the dose rate at 45 cm if the lead is used? **Justify your answer and show all work.**

20 D. List two other corrective actions that could be taken to minimize dose to the technician (in addition to shielding the dialysis apparatus). **Number your responses. Only the first two will be graded.**