

1. A worker has spent four hours working in a glovebox room without respiratory protection before it is noticed that a tear in a glove has caused high airborne Pu-239 contamination in the room. The worker wore a personal air sampler throughout the work. Analyzing the filter, it is found that the average airborne concentration in the room during the work was $1\,000\text{ Bq/m}^3$. According to ICRP 68, the inhalation dose coefficient for this form of Pu-239 is $3.2\text{E-}5\text{ Sv Bq}^{-1}$
 - (a) What is the “dose” to the worker?
 - (b) The workers physician would like your advice on counseling the patient. What are the main points that should be expressed?

2. A worker is using a stock solution of P-32 carelessly and accidentally gets a 10 ul drop in their coffee (which they subsequently drank). If the stock solution contained 10 mCi and the volume was 1 ml, what dose would the worker receive?

3. What dose would you expect to result from the exposure of a worker to an environment with 100 DAC of tritium oxide for 8 hours?

4. The radiological half life of Technetium-99m is 6.01h. The biological half life of a given labeled compound in the body is 24h and that it is excreted in urine. Assume the compound is instantaneously uniformly distributed to the whole body after injection.
- (a) For every Bq that is injected, what activity can be expected to leave the body in urine?
 - (b) For every Bq that is injected, what is the number of disintegrations that occur in the body?
 - (c) What do you expect the activity in the body to be at the following times after injection?
 - (i) 6.01 h
 - (ii) 24 h

5. After a spill, a stock solution of I-125 is instantaneously and uniformly distributed to the air in a small room. The room volume is 10 m^3 and the ventilation rate is 1 m^3 per hour. The activity of the stock solution was $3.7 \text{ E}10 \text{ Bq}$.
- (a) What is the initial concentration in the room expressed as a multiple of the DAC?
- (b) At what time after the spill would you expect to be able to conduct cleanup operations without using a respirator? Your facility policy requires a respirator for exposures to concentrations $> 1\text{DAC}$.