QUESTION 4

You are the project health physicist decommissioning a hot cell that manufactured thermoelectric generators from ^{90}Sr, with strontium nitrate being converted to strontium titanate. Most of the radioactivity is in steel tubing in the hot cell and only strontium nitrate has been found so far. All external surfaces within the hot cell and the adjacent isolation room also have high levels of removable and fixed surface contamination.

GIVEN

- ICRP-30 model
- The stochastic inhalation ALI for Class D ^{90}Sr = 20 μCi
- The non-stochastic inhalation ALI (Bone Surfaces) for Class D ^{90}Sr = 20 μCi
- The stochastic inhalation ALI for Class Y ^{90}Sr = 4 μCi
- Strontium nitrate is Class D and strontium titanate is Class Y.
- Counting efficiency of GM instrument with a pancake probe for ^{90}Sr on an air filter paper = 25%
- Air flow of a high volume air sampler = 4.0 L min^{-1}
- Reference Man breathing rate (light activity) = 20 L min^{-1}
- From NUREG/CR 4884, the fraction of any initial intake of Class D ^{90}Sr in a 24-hour urine void beginning directly after intake = 0.0857

POINTS

STATE ALL ASSUMPTIONS

15 A. A worker in the isolation room may have been exposed to airborne ^{90}Sr. Identify two (2) qualitative measures you can take to see if the individual was exposed. **Number your responses. Only the first two will be graded.** Identify three (3) quantitative analyses you can do to estimate exposure. **Number your responses. Only the first three will be graded.**

15 B. Assume that the worker was exposed to strontium nitrate and that a 24 hour urine void taken directly after the exposure has a ^{90}Sr activity of 2.62 μCi. What is the estimated committed effective dose equivalent (CEDE) to the individual? **State all assumptions and show all calculations.** List the two (2) primary reasons why a dose estimate that was based on a urine sample collected immediately after the exposure would not be accurate. **Number your responses. Only the first two will be graded. Explain your answer.**

15 C. During robotic dismantling activities a continuous air monitor alarms in the hot cell because of an inadvertent release of source material. A 5-minute high volume air sample from the isolation room reads 10^3 cpm on the GM instrument with a pancake probe. What is the DAC level in the isolation room? **Show all calculations.** Workers are wearing full-face respirators with a respiratory protection factor of 50. Based on the potential internal dose, will you allow work to continue in the isolation room? **Justify your answer.**

5 D. For the situation in part C, you discover that ^{90}Sr is in the form of strontium titanate. How would this information change the internal dose estimated in part C above? It is not necessary to repeat the calculation. Describe qualitatively what the result will be.