

**QUESTION 4**

You are a senior health physicist at a national waste disposal site. You open a package of radioactive waste to perform a visual inspection for liquid. The waste consists of a glove box line used for recovery of  $^{239}\text{Pu}$ . The line was removed and packaged as waste in 1975.

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- No liquids in the waste at the time of packaging; primary contaminants are  $^{241}\text{Am}$  and  $^{239}\text{Pu}$  (0.05 gram contaminant total).
- The outside of the waste container shows no detectable contamination. Historical data show that the inside of the glove box was uniformly contaminated to levels of  $10^6$  dpm/100 cm<sup>2</sup> alpha when it was placed into the container. No beta or gamma contamination was reported.
- Gamma radiation surveys of the waste container show one area with gamma dose equivalent rates above background to 5 mrem hr<sup>-1</sup> on contact with the waste box.
- Neutron surveys show no detectable activity.
- Estimated workload is 40 person-hours.
- DAC for  $^{239}\text{Pu} = 2 \times 10^{-6} \mu\text{Ci m}^{-3}$
- DAC for  $^{241}\text{Am} = 2 \times 10^{-6} \mu\text{Ci m}^{-3}$

**STATE ALL ASSUMPTIONS****POINTS**

- 25** A. Describe how you would set up the work area. Provide examples of radiological protection controls in the following categories: 1) engineering controls, 2) personal protective equipment (PPE), 3) personal monitoring, 4) air monitoring/sampling, and 5) job coverage requirements. **Explain your answers and provide examples.**
- 10** B. Assume an air concentration of  $6 \times 10^{-5} \mu\text{Ci m}^{-3}$  for  $^{239}\text{Pu}$  and  $4 \times 10^{-5} \mu\text{Ci m}^{-3}$  for  $^{241}\text{Am}$ . The respirators available for the job have a respiratory protection factor of 100. Given an administrative airborne exposure limit of 40 DAC-hours for the activity, is the projected exposure for this job acceptable? **Show all calculations and explain why the projected exposure is or is not acceptable.**
- 15** C. Using a respiratory protection factor of 100, an air concentration of 50 DAC ( $^{239}\text{Pu}$  plus  $^{241}\text{Am}$ ), and a dose equivalent rate of 5 mrem hr<sup>-1</sup>, what is the collective dose equivalent estimate for this job? **Show all calculations.**