

QUESTION 12

You are the Health Physicist providing health physics coverage for a radwaste shipment from an operating BWR nuclear power station. You have 1 liner containing 25 cubic feet of resin, solidified in cement, 3000 pounds net weight, to ship. The radiation level at 1 foot from the unshielded liner is 10 R/hr.

You will place the liner inside of 1 of 2 available shipping casks: Cask A or Cask B. Cask A, a DOT-certified Type A cask, has 5 cm of lead shielding; Cask B, a DOT-certified Type B cask, has 10 cm of lead shielding. The cask selected will be shipped on an exclusive use, unenclosed, flatbed trailer.

Radiochemistry has analyzed the resin, with the following results:

Concentration ($\mu\text{Ci}/\text{cm}^3$):	^{60}Co	^{54}Mn	^{90}Sr
	5.2	10.	8.7

The LSA concentration limits are shown below:

LSA Concentration Limit (mCi/g):	^{60}Co	^{54}Mn	^{90}Sr
	0.3	0.3	0.005

Points

- 2 A. What is the activity of each radionuclide to be shipped in Ci?
- 2 B. Can this be an LSA shipment? Justify your answer with calculations.
- 2 C. What would be the transmitted gamma dose rate at the exterior wall of each cask if used for the resin? Show all calculations.
- 2 D. Are there any DOT radiation level restrictions which apply to this shipment? If so, specify the applicable restriction(s).
- 2 E. As a final check, you take a gamma radiation level measurement at the cask exterior wall, with 96 mR/hr as the result. What is the significance, if any, of this measurement? What actions, if any, should be taken?

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$$1 \text{ ft}^3 = 2.8 \times 10^4 \text{ cm}^3$$

$$1 \text{ lb} = 454 \text{ g}$$

$$\text{Density of lead} = 11.34 \text{ g}/\text{cm}^3$$

$$\text{Mass attenuation coefficient for 1 MeV gamma in lead} = 0.0708 \text{ cm}^2/\text{g}$$

Assume 1 gamma per disintegration with 1 MeV average energy.

Assume buildup factor, B, for 5 cm of lead at 1 MeV gamma = 2.

Assume buildup factor, B, for 10 cm of lead at 1 MeV gamma = 3.

Assume distance from outside of resin liner to outside of shipping cask (through the shielding) to be 1 ft.