

QUESTION 14

The following questions pertain to environmental monitoring principles.

GIVEN

1 gallon = 3.785 liters

According to HPS N13.30-1996, when the background and sample count times are the same, the equation for Minimum Detectable Amount (MDA) can be represented by the following equation:

$$MDA = \frac{4.65s_b}{KT} + \frac{3}{KT}$$

s_b = The standard deviation of the background count rate

T = Sample and Background Count Time

K = Calibration Constant, counts per time per disintegration

POINTS

- 20 A** Assume that a Gaussian dispersion model applies to a gaseous release. For the following conditions, would the centerline airborne radioactivity concentration on the ground at the site boundary (1 km from the release point) increase, decrease, or remain the same? **Justify your answer for each.**
1. The effective release height is increased
 2. The wind speed increases
 3. The ground temperature, which initially exceeds the temperature at 100 meters above the ground at the beginning of the release, decreases below the temperature at 1000 meters.
 4. The gaseous effluent is heated above the ambient temperature and ejected from a vertical stack with a velocity exceeding that of the existing wind speed.
- 20 B** Assume a release through a pipe to the bottom and in the middle of a wide, shallow, straight river. For the following release conditions, will the downstream centerline radioactivity concentrations in the river increase, decrease or remain the same? Justify your answer for each.
1. What is the effect on liquid radioactivity concentration if the temperature of the discharge is increased?
 2. What is the effect on liquid radioactivity concentration from an increased velocity of the discharge?

3. What is the effect on the liquid radioactivity concentration from an increase in the river current?
4. What effect does time have on the concentration of radioactive material in the sediment on the river bottom?

25 C A counting laboratory needs to establish the counting time of sediment samples for a given procedure and stated MDA:

Counting efficiency = 0.2 c/d
Background count rate = 85 cpm
Desired MDA = 0.1 pCi/g
Sample size = 500 g of sediment

If the counting time for both the background and the samples is the same, is a count time of 4 minutes sufficient to meet the desired MDA? **Show all work.**

35 D Laboratory analysis shows that a holding tank with 15,000 gallons of water contains Cs-137 at a concentration of 8.81×10^3 pCi/ml. It is to be released over a 2-day period to a stream with a flow rate of 200 cfs. Calculate the dose to a theoretical individual who consumes 250 g of fish from the stream after this release if the bioaccumulation factor is 2000 and the ingestion ALI, based on ICRP 30 guidance, is 100 mCi. **Show all work.**