

QUESTION 6

A worker at a facility where ^{131}I materials are manufactured appears to have a positive result for ^{131}I in a spot urine sample. The chemical form of the ^{131}I is NaI. The sample was taken late in the day, after the majority of the day was spent working with ^{131}I . No air sample results are available for this case.

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- From external thyroid counting, the following data are obtained:

| <u>Time Post Intake (d)</u> | <u>Thyroid Activity (kBq)</u> | <u>IRF*</u> |
|-----------------------------|-------------------------------|-------------|
| 1 | 250 | 0.133 |
| 7 | 230 | 0.0995 |
| 10 | 130 | 0.0751 |

* Intake Retention Fraction for Inhalation of Class D ^{131}I – fraction of intake expected to be in the thyroid this time post-intake. NOTE: Radioactive decay is accounted for in these values.

- For inhalation of class D ^{131}I , the dose conversion factor for thyroid is $2.9 \times 10^{-7} \text{ Sv Bq}^{-1}$
- Approximately 75% of ^{131}I as NaI is excreted from the body in the urine in 1-2 days with an effective halftime of about 6 hours. The remaining 25% of ^{131}I will be trapped in the subject's thyroid, reaching a maximum about 24 hours post-intake, and be excreted with an effective half-time of about 7 days
- 10CFR20 Organ Dose Weighting Factor, w_T , for the thyroid is 0.03

POINTS**STATE ALL ASSUMPTIONS**

- 20** A. Given that you can choose *in vivo* or *in vitro* methods of analysis to perform bioassay, describe and discuss the optimal approach for this case. In your discussion list two advantages and two disadvantages for *in vitro* and for *in vivo* methods of analysis as related to this case. **Justify your answer. Number your responses. Only the first two advantages and the first two disadvantages for *in vitro* and for *in vivo* methods will be graded.**
- 10** B. How might your approach to bioassay change as time goes by, given the metabolic model for iodine? **Explain your answer.**
- 10** C. Based on the thyroid counting data given, what is your best estimate of the subject's intake? **Show all calculations.**

- 10 D. Assume that the intake was 5 MBq. What is the committed dose equivalent (CDE) to thyroid for this intake? What is the committed effective dose equivalent (CEDE) for this intake? Assume that organs other than the thyroid make a negligible contribution to the CEDE. Have any regulatory limits been exceeded? **State all assumptions and show all calculations.**