Editorial

DISPOSING OF CARBON-14 WASTES

Helicobacter pylori (HP) that produces enzyme urease may predispose humans to inflammatory condition of stomach thought by some to cause peptic ulcer and gastric cancer (1). Gastric urease can be detected noninvasively by measuring isotopic CO_2 excretion in breath following oral administration of C-14-urea. Since C-14-urea does not have a major route for entry into metabolic pathways, it is excreted as either $^{14}CO_2$ in breath or as unchanged C-14-urea in urine (2), and therefore, the patient dose resulting from this new procedure may be lower compared to the older C-14 breath tests.

With the advent of C-14-labeled urea breath test (UBT) that is now underway in many countries around the globe (3-6), and which is currently under investigation in our institute in conjunction with Department of Gastroenterology of Shariati Hospital, ways of disposing of this hazardous C-14 with half life of over 5000 yr, seems utterly important. Urea is classified as harmful by inhalation and if swallowed. It is irritating to eyes, respiratory system and skin, with a possible risk of irreversible effects.

Radiocarbon is present in nature, at some 22 metric tons or 110 million Curies, therefore, the amount avaiable for disposal will not significantly affect the quantity of C-14 already in nature (7). However, careful actions should be taken to prevent the harmful localized concentrations of this radiocactive substance due to waste disposal practices. The maximum atmospheric concentration, based on radiological considerations for occupational exposure to C-14 is listed in the U.S. code of Federal Regulations (10CFR-20) as 5×10^{-5} μCi/ml (1.85 MBq/cm^3). The following are the listings of various methods concerning the disposal of C-14 (8).

1. **Isotopic dilution.** Carbon-14 may be disposed of in any manner if it is intimately mixed with stable carbon, and in the same chemical form. It is assumed that the discharged C-14 is sufficiently mixed with the garbage so that the average ratio of C-14 to stable carbon stays essentially constant.

2. **Sewers.** Carbon-14 may be discharged to sewers provided the amounts do not exceed 1mCi/100gal of sewage depending on the sewage flow available to the institution.

3. **Atmospheric dilution.** Carbonates containing C-14 may be converted to carbon dioxide and released directly to atmosphere. The operation should be carried out in a hood. The velocity of air flow should not be less than 50 linear feet per minute and not exceeding 100μCi/h/ft^2 of air intake in the face of the hood. Conversion could be done by slow addition of acid in a device similar to the alkalimeter that is used in the quantitative estimation of carbonates. The complete release would probably last 15 to 30 minutes.

4. **Garbage.** Carbon-14 may be disposed of with garbage provided the amounts do not exceed 1μCi/1b of garbage available within the institution. Disposal should not be considered for open dumps from a sanitation viewpoint the least. If it is dumped in the open, the garbage would be decomposed completely in about 30 months and most of the C-14 will be released to the atmosphere. If it is dumped in sanitary fills, the garbage would decompose slowly over the years and will be converted to gases.

5. **Burial.** Materials containing C-14 may be buried provided they are covered with at least 4 feet of well compacted earth and the maximum permissible amount of C-14 in chemical compounds mixed with one cubic foot of soil should not exceed 10 mCi. The materials containing C-14 should not be buried in sealed containers which would prevent dispersion.

6. **Incineration.** Combustible materials containing C-14 may be incinerated if amounts of carbon do not exceed 5μCi/g of material and if mixed with natural fuel so that no more than 5μCi/1b of fuel is burned.

It is strongly suggested that centers utilizing C-14, have necessary and sufficient information for handing this radioactive substance and further, get help and approval from the authorized organization prior to disposal by any one of the above methods.

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