Additional Procedure for the use of Tritium

Tritium is an emitter of very soft $\beta$-particles which have a maximum energy of 18.6keV. The maximum range of such particles in air is 6mm. It is therefore impossible to measure levels of tritium contamination with any of the monitors typically used for other radionuclides.

Routine monitoring must be conducted by means of the wipe test method.

Storage of both tritiated water and aqueous solutions of tritiated compounds in freezers may give rise to contamination of the frost within the freezer. Tritiated compounds must be stored in containers with air-tight seals (e.g. O-ring seal eppendorfs). Double or triple containment is recommended (e.g. O-ring seal eppendorf inside grip-seal bag, within air-tight plastic container). Routine monitoring of such freezers should be undertaken by scintillation counting of samples of the ice.

[Tritiated water should be stored at room temperature in a suitable store where practicable.]

Wipe Test Method

Moisten a suitable wipe, such as a glass-fibre disc small enough to fit into a liquid scintillation vial, with water or other solvent in which the contamination is soluble. (Glass fibre is preferable to paper as it is wetted more effectively by the liquid scintillant and produces a higher counting efficiency - important when detecting H-3. Some commercial wipes are made of materials such as polystyrene which dissolve in scintillation fluid and enable efficiency to be determined by the usual methods.)

1) Wipe a known area of surface, normally 100 or 1000 cm$^2$.

2) Place the wipe into a scintillation vial with 10 cm$^3$ of liquid scintillant.

3) Count the activity in a liquid scintillation counter.

4) In the absence of any more accurate information assume that 10% of the activity on the wiped surface has been transferred to the wipe.

5) Calculate the contamination level using the formula

\[
\text{contamination level (Bq cm}^{-2}\text{)} = \frac{C \times 100 \times 100}{A \times \text{Eff} \times T}
\]

where $C$ = count-rate in cps, corrected for background

$A$ = area wiped in cm$^2$

$\text{Eff}$ = percentage counting efficiency for isotope in question

$T$ = percentage of contamination picked up (normally 10%)

Efficiency is (CPM / DPM) x100 for that isotope.

Example: An area of 1000 cm$^2$ contaminated with tritium, is wiped. The wipe is counted in a liquid scintillation counter which has an efficiency of 30%. A count-rate of 9000 cps is obtained,
Contamination level = \[ \frac{9000}{1000} \times \frac{100}{30} \times \frac{100}{10} \]

i.e. the contamination level is 300 Bq cm\(^{-2}\).

This method will give a reasonable estimate of removable contamination, but not of fixed contamination. For measuring contamination from a gamma emitter the same method should be used but instead of using liquid scintillation counting the wipe should be counted in a gamma counter.

<table>
<thead>
<tr>
<th>Column 1 Nuclide</th>
<th>Column 2 Working Limit (Bq cm(^{-2}))</th>
<th>Column 3 Emergency Action Level (MBq)</th>
</tr>
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<tbody>
<tr>
<td>H-3</td>
<td>2000</td>
<td>1100</td>
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