MRB500 Tritium Collection

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The tables below illustrate the design concept of the MRB500 by depicting (%A vs %B vs %C):

Run Time (hr)	Two 5 cc Glycol Vials	Two 10 cc Glycol Vials	Two 15 cc Glycol Vials
8	99.9	99.9	99.9
24	98.2	99.8	98.9
72	86.9	94.6	98.2
168	75.6	81.6	91.9

Flow Rate: 125 cc/min R.H: 55%

Run Time (hr)	%Retention First Vial	%Retention Second Vial	%Retention Third Vial
8	99.8	0.1	□
24	99.0	0.8	0.1
72	81.0	17.0	2.0
168	61.0	30.0	9.0

Flow Rate: 125 cc/min R.H: 55%

The tests were performed using a tritium gas standard continuously passing through the bubbler with standard 20 cc vials. The values represent the % retention of tritium in each vial.

The 20cc vials are used as the standard for numerous reasons including: 1) readily available with LSC, 2) smaller volume requires less flow rate which provides much higher oxidation efficiency due to longer resonance time, 3) lower flow rate provides less component wear, 4) lower flow rate can be more precisely controlled and measured over time, 5) less overall tritium in sample while having sufficient amount for 10 repetitive measurements per vial.

There are various mechanisms (i.e. tritium concentration, humidity, ambient temperature, flow rate, tube/glycol interface, glycol volume, etc.) that influence the retention. For applications involving higher tritium concentrations or longer sampling intervals or higher ambient humidity levels, we generally recommend reducing the flow rate from 150 sccm to 100 sccm or less to prevent reaching a point of saturation. It is worth noting that mass transfer of ethylene glycol can be seen or weighed. The counting procedures should include a weighing of the samples to supplement the pipetting of sample volume for measurement.

Reagent grade ethylene glycol is used due to its low vapor pressure, water retention, and LSC compatibility characteristics. Our research and development efforts indicate that the most efficient and practical configuration was the use of two trains each consisting of three 20cc vials containing 10ml of ethylene glycol each. This vial assembly design is matched to the tubing and flow rate of the bubbler. The standard design of the MRB500 operated at prescribed conditions would typically retain nearly all tritium in vials A and D during a 24 hour run. However, for a one week run, we expect to rely on the second and third vials of each set.

The MTS bubbler units undergo oxidation and collection efficiency evaluation tests. These tests indicate that 100% of the tritium is oxidized to HTO and (as seen in the data of the table above) 99.9% and more of the tritium is captured in the vials. This performance is crucial to provide accurate tritium measurements.