INSTRUCTIONS

Using a standard test source to check a GM counting system

Checking the GM counting system
This procedure has been set and agreed with CLEAPSS. Carry out these checks prior to annual leak tests and contamination checks. Work well away from any other radioactive sources.

Keep a Test Record, as shown below.

Apparatus required

- GM tube in holder with lead;
- Counting unit (scaler);
- Clamp and stand;
- Standard potassium test source (procedure 1);
- Normal school plutonium or americium sealed radioactive source (procedure 2).

Procedure 1 – Measuring comparative beta efficiency
1. Position the GM-tube vertically so the end window is pointing uppermost. Clamp the tube holder, not the tube itself.
2. Remove the protective end cap carefully (usually white or blue with a 'spider's web' grille). The window is fragile and the GM tube will be ruined, if it is damaged.
3. If the GM voltage on the counter is adjustable, set it to 450 volts.
4. Rest the standard test source on the GM tube, so the source rests on the metal rim, with the disc of potassium chloride directly covering the centre of the GM window.
5. Note the count, over a period of 1000 s, in the Test Record.
6. Remove the test source well away from the tube and record the background radiation counted over 1000 s. This should be 350 to 500 counts. Try moving another area of the lab, if it is higher.
7. Replace the protective cap on the tube.

Procedure 2 – Check for alpha sensitivity
Follow standard operating procedures when using radioactive sources. Position an alpha-emitting school sealed source (americium-241 or plutonium-239) about 10mm from the GM-tube window. Check that the count rate increases and then decreases considerably when a piece of paper is placed in front of the source. Note that americium-241 also emits significant gamma radiation and the GM tube will still detect this through the paper.

Recording and processing the results
The record of the test should include the exact combination of monitoring equipment used. If no serial number or unique identifier is present on a particular piece of equipment, a suitable label should be added. This complete counting system must then be used whenever leak tests and contamination checks are necessary.

Test record for a Geiger-Muller counting system	
Equipment used	**Serial no or unique identifier**
GM Tube (with protective cap removed, if fitted)	
GM Tube holder	
Connecting lead	
Counting unit (scaler)	
Operating voltage (ideally set to 450V)	volts
Standard test source used	**Serial no or unique identifier**
K-40, naturally occurring in 300 mg KCl	
Measurements taken Actual count for 1000 seconds	
K-40 test source resting on GM tube window (t)	
Background (b) (typically be 350 to 500 counts in 1000s)	
Comparative beta efficiency of system	
=100 (t – b)/540 (should be at least 70%)	= _____ %
Comparative beta efficiency	Pass/Fail (delete as appropriate)
Check for alpha detection	Pass/Fail (delete as appropriate)
Overall result (ie, 2 tests above passed)	Pass/Fail (delete as appropriate)
Test carried out by:	
Signed: Date:	

If the instrumentation fails its test

If the beta efficiency is below 70%, (or considerably above 100%), or the alpha sensitivity test is failed, maintenance or replacement of some or all parts the system is likely to be needed.

Before purchasing a new GM tube, check that it is:

- operating at the correct voltage (usually 450V);
- well away from other radioactive sources during the tests;
- not contaminated (clean it carefully with a damp soft tissue);
- free from additional covering or protection over the window;
- Connected via a good lead to a properly-functioning counter (scaler). See comments below.

Before purchasing a new GM tube, it is advisable to ensure that the holder, lead and counting system work properly, when used with another tube known to be working correctly.

Failure of components or electrical connections in the holder, lead or counting unit sometimes results in incorrect or intermittent readings. If the system still does not work with a good tube, substitution of individual parts of the system, one at a time, should locate the problem. In order to do this, a similar system might need to be borrowed from another school.