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SUBJECT: 0.005 uCi Sensitivity for Dickinson College

COMMENTS:

See attached, as requested.

DATE: 5/26/05 **TIME:** 11:25 am

NUMBER OF PAGES TO FOLLOW: 2

Verification of 0.005 μCi sensitivity for Dickinson College Survey Meter
John Luetzelschwab, PhD, CHP
May 24, 2005

Alpha (plutonium)

Two Pu-239/Pu-240 plated alpha sources were counted in a 2-pi counter (50% efficiency) to determine their activities. These sources have a diameter of 4 cm. The filter paper used for the wipe test has a diameter of 12 cm, but generally the sources are wiped only on the central area of the filter paper; about the area of a 4 cm diameter circle.

Results:

Survey meter background count: $0.25\text{k} \pm 0.15\text{k}$ cpm

The following data are for the two sources: one line for each.

<u>Measured</u> (cpm)	<u>Activity</u> (dpm)	<u>Activity</u> (μCi)	<u>Survey meter</u> (cpm)*	<u>Source alone</u> (cpm)
1330 ± 80	2660 ± 160	0.00120 ± 0.00007	$1.25\text{k} \pm 0.25\text{k}$	$1.0\text{k} \pm 0.30\text{k}$
10115 ± 520	20230 ± 1040	0.00911 ± 0.00047	$7.5\text{k} \pm 1.0\text{k}$	$7.25\text{k} \pm 1.0\text{k}$

*Total of source plus background

The uncertainties include counting uncertainty plus a 5% uncertainty for voltage shifts.

Expected count rate for 0.005 μCi : $4.2\text{k} \pm 0.6\text{k}$ cpm.

This is approximately 16 times background and easily detected.

Beta (Cs-137)

A calibration source containing Cs-137 spread evenly over an encased filter paper of diameter 4.8 cm was counted with a 3" NaI detector/MCA gamma analysis system. This source was purchased from Analytix Corp. in 1993 and is traceable to NIST standards with a $\pm 2\%$ uncertainty. Based on the initial activity of the source, the date of calibration, and the date counted, the activity of this source was 0.02465 ± 0.0005 μCi . This source produced a net count of $105,900 \pm 350$ counts in the 0.662 MeV peak in a 10 minute live time count.

A few drops of Cs-137 in a liquid solution were put on a 4.8 cm diameter planchet (again, this would be about the area of the paper filter that might contain radioactivity from a wipe test). A small drop of soap was added to the solution to reduce surface tension so the liquid would spread evenly over the area of the planchet. The source was then dried in an oven. When counted in the same geometry as the calibration source, this Cs-137 source produced a net count of $213,516 \pm 480$ counts in the 0.662 MeV peak in a 10 minute live time count. Based on these counts, the activity of this Cs-137 source was 0.0481 ± 0.0098 μCi .

With the survey meter placed over this Cs-137 source, the meter recorded a count rate of $16\text{k} \pm 2\text{k}$ cpm. Subtracting background, the source itself produced a count rate of $15.75\text{k} \pm 2\text{k}$ cpm. Based on these numbers, a $0.005\ \mu\text{Ci}$ source would produce a count rate of $1.64\ \text{k} \pm 0.2\text{k}$ cpm. This is about six times background and easily detected.