CHAPTER 38

Vagaries of Wipe Testing Data

Jill Eveloff, Howard Tisdale, and Ara Tahmassian

At the University of California at San Francisco, the common radioisotopes ^{3}H, ^{14}C, ^{35}S, and ^{32}P constitute over 80% of all radioisotope usage. An effective technique for determining contamination by these isotopes is wipe testing and liquid scintillation counting (LSC). The State of California requires all radioactive materials users at UCSF to maintain wipe test data of their laboratory to demonstrate contamination control. The Radiation Safety Department of the Office of Environmental Health and Safety at UCSF provides a special service to its research staff and radioactive materials users. This service performs wipe tests of their laboratories in accordance to their required monitoring frequency. This includes the analysis of the wipes taken.

Because of the large volume of wipe test analyses performed by our office, it is important to understand some of the vagaries associated with wipe testing data. This knowledge helps our office provide better service to the university community. The vagaries investigated include the following:

- effects on wipe test data of wiping two different surface materials
- effects on wipe test data using three different wipe media
- effects on wipe test data using varying amounts of cocktail
- effects on wipe test data of self-absorption in the wipe media
- frequent complications to tritium monitoring from fluorescence

INVESTIGATIONS OF SURFACE MATERIALS AND WIPE MEDIA

The efficiency of detecting low level contamination of ^{3}H, ^{35}S, and ^{32}P was tested using two lab bench surfaces, transite and wood. These materials were chosen because they are most common in laboratories at UCSF. Wipes of each isotope from each surface were made using three different wipe media; a two-inch diameter dry wipe, a two-inch diameter wet wipe, and a 0.25 × 4.0 inch piece of scotch tape. These wipes were conducted using controlled activities of 4000 cpm, per isotope, per wipe, and on controlled 3 × 3 inch surface areas. The results, % cpm removed by wipe, are shown in Table 1.

Table 1. % CPM Removed by Wipe

	Wood Surface			Transite Surface		
	^{3}H	^{35}S	^{32}P	^{3}H	^{35}S	^{32}P
Dry wipe	0.7	2.1	4.5	0.0	2.2	5.6
Wet wipe	0.2	9.3	18.7	2.8	37.3	33.9
Scotch tape	1.7	1.7	5.1	4.3	11.7	15.8

INVESTIGATIONS OF VARYNG COCKTAIL VOLUME AND SELF ABSORPTION-EFFECTS

The efficiency of detecting low level contamination of ^{3}H, ^{35}S, and ^{32}P was tested using different volumes of scintillation cocktail: 10 mL, 5 mL, and 2.5 mL. In addition, the of self-absorption effects of the isotope by the wipe media was investigated. Controlled amounts of isotope activities were placed directly on two-inch diam dry wipes and inserted in vials with specific volumes of scintillation cocktail. The results, % cpm recovery, are shown in Table 2.

FLUORESCENT COMPLICATIONS IN TRITIUM ANALYSIS

The detection of ^{3}H contamination was found to be complicated frequently by the interference of fluorescent compounds. With the wide variety of research done on the UCSF campus, there exists the probability of encountering chemical compounds with fluorescent components during typical wipe testing procedures. Fluorescence may frequently produce significant cpm in the ^{3}H counting channel (up to 18.6 keV). It is sometimes impossible to know the difference between fluorescence and ^{3}H contamination unless spectrum analysis is performed.

Most present day LSCs have spectral analysis capabilities; however, some have associated computer software which will generate graphic representations of the spectral analysis. These representations can show, most obviously, the differences between fluorescence and ^{3}H contamination. A typical ^{3}H spectrum is shown in Figure 1 and a typical fluorescence spectrum in Figure 2; however, fluorescence spectra, are not restricted to the type seen in Figure 2. The differences between the two spectra can be seen with close observation.

Table 2. % Recovery of CPM

ISOTOPE	ACTIVITY (CPM)	COCKTAIL VOLUME 10 mL	5 mL	2.5 mL
^{3}H	456	20.6	18.2	16.2
^{3}H	4748	19.7	16.1	13.1
^{35}S	766	56.8	63.7	65.9
^{35}S	6525	62.5	63.0	63.6
^{32}P	519	94.4	91.3	91.0
^{32}P	5098	99.5	100.0	100.0

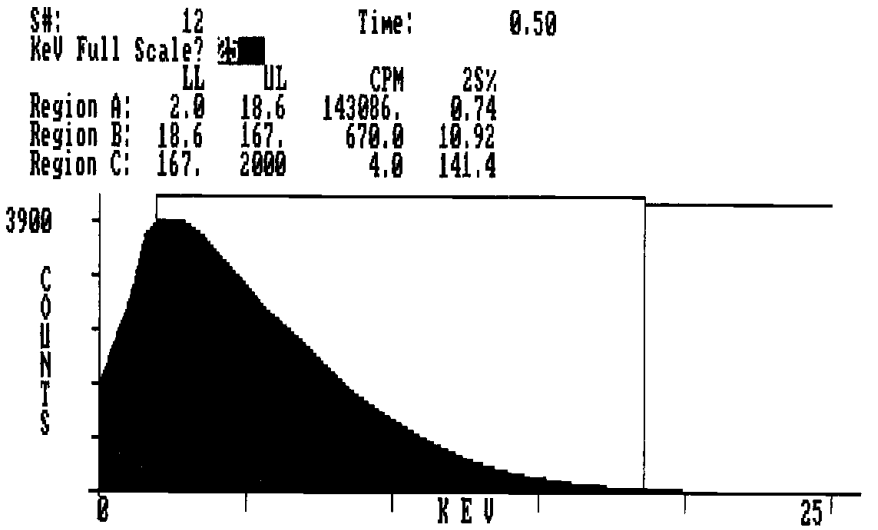

Figure 1. Typical ^{3}H spectrum.

The differences include both the distribution of energies (i.e., up to Emax) and the average energy; therefore, it is always prudent to take one step further in ^{3}H contamination analysis by evaluating whether the source of counts could be attributed to fluorescence.

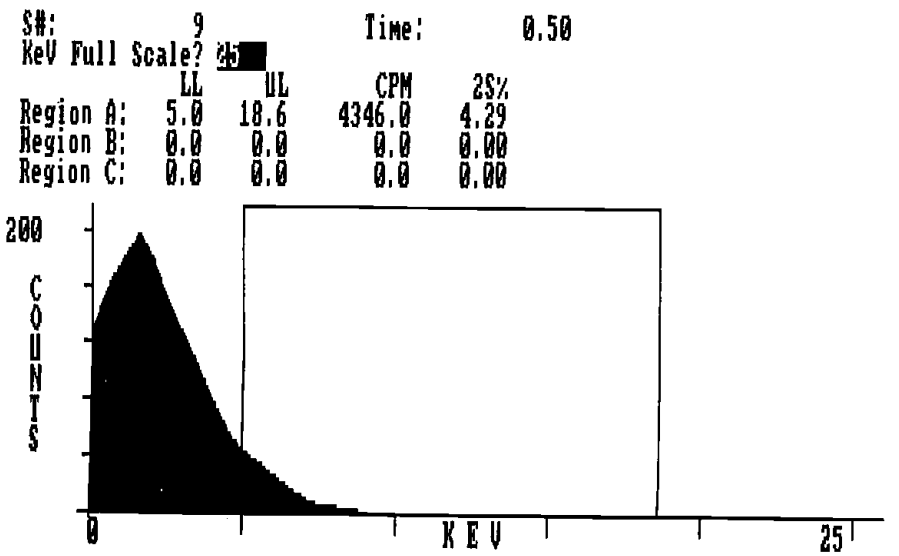

Figure 2. Typical flourescence spectrum.

RESULTS

A summary of the results of these experiments is as follows:

- Contamination can be more easily removed by wipe from transite as opposed to wood surfaces.
- Low level ^{3}H was difficult to detect under all conditions studied.
- Wet wipes provide the more efficient contamination removal.
- Scotch tape also increased the efficiency of contamination detection.
- Dry wipes produce up to 80% self absorption of ^{3}H samples, 40% self-absorption of ^{35}S samples, and very little self absorption of ^{32}P
- Very slight decreases in % recovery of cpm was seen in reduction of scintillation cocktail used per sample (The implications here for cost savings are incredible.)

The results of this somewhat shallow study produce thought trends that can be used in wipe test data manipulations and/or analysis. All samples used in this study were counted in a Packard LSC model 2000CA.