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Use of Multiple Swabs for Sampling

Who says you can't teach an old dog new tricks? Well, this old dog has learned a new trick, or at least now has a different view. If you had asked me about swab sampling five years ago, I would have generally said that the preference is to use only one swab for a given site. Multiple swabs (that is, multiple swabs for the same site or area) were to be used only if recovery with one swab was low and the percent recovery needed to be improved. I am now an advocate of using two swabs per site. What has made me change my opinion?

Those of you who follow my writings and training know that I am skeptical of people who insist that swabbing is a very precise sampling method. The reason I am skeptical is that I see percent recoveries bounce around significantly, from operator to operator and even from sample to sample for the same operator. Now there are many factors which cause variability in swabbing recoveries. However, I believe the main one is related to how much liquid is left on the swab after it is removed from the wetting solution. Typically this is "controlled" by pressing the swab head against the side of the vial holding that liquid, to express the excess liquid from the swab head.

The reason for expressing excess liquid from the swab head is that any excess liquid will likely be left on the swabbed surface after swabbing. That is, the swabbed surface is not dry after swabbing. Look next time you do swab sampling if you doubt this. (Of course, the exception to this is the use of volatile solvents like methanol. In that case, you may leave liquid behind, but it will immediately evaporate. However, the rationale I am giving below still applies to that situation.) The amount of liquid left behind will affect the percent recovery. Assuming the concentration of the residue is the same in the liquid left on the surface as the liquid retained by the swab, the recovery will be reduced by an amount equivalent to the ratio of the amount of liquid left on the surface to the total amount originally on the swab. So regardless of all the other reasons for low recoveries and for variable recoveries between replicates, you start off getting a lower value for recovery by using only one swab.

How much lower this recovery is will depend on the amount of "excess" liquid left on the surface. The variability of recovery percentages will depend on the variability of how much liquid is left on the swab after expression of excess liquid. So, how can we reduce these effects? Simple. Just use two swabs on every surface. (For full disclosure, I am have not been paid by swab suppliers for this Cleaning Memo or for any other related consulting.) Of course, it is best (at least for addressing this issue of excess liquid) to make sure that second swab is used dry. By using a second dry swab, you essentially "mop up" any liquid left behind. For clarification, the two swabs are put in the same vial for analysis for residue. However, to convince yourself that this is real, you might do a study in which the first wet swab and the second dry swab are put in separate vials for analysis. That way, you will be able to put a number on the incremental recovery.

However, the incremental recovery is not necessarily the most important issue that this multiple swab technique addresses. It also addresses what I believe is the main reason for variability of swab recoveries between operators. That is, it minimizes any effects due to the variable amount of liquid that is left on the swab after expressing excess liquid against the vial side. One operator may leave very little liquid with the wet swab, while a second operator may leave significantly more liquid on the wet swab. By having each operator follow the wet swab with a dry swab, the vast majority of the liquid left behind (in each situation) should be

recovered. The result should be much greater consistency from operator to operator. There are some things you can do to convince yourself of this variability. Choose two or three qualified swab operators. Pre-weigh each dry swab. Have each person dip the swab into a vial and express the excess liquid, and then weigh the wet swab again. Determine the amount of liquid taken up by the swab. That difference may show up as different amounts of liquid left on the surface after swabbing. If you do three replicates for each person, you should be able to determine the variability among the operators.

So, my opinion for situations where the liquid for swabbing is predominantly non-volatile is that is preferable to develop swabbing procedures using two swabs, with the first swab wet and the second swab dry. I believe this will both increase the percent recovery, but moreover it will decrease variability of percent recovery from person to person. Of course, if the liquid used is volatile, it may be preferable to use two swabs, with both swabs wet.

There is no regulatory reason to prefer this option of two swabs. However, I believe there are practical reasons. For example, it will probably end a number of situations where you spend extra time investigating a recovery study because one person got a significantly lower recovery than the other(s). In addition, since common practices are to use either the lowest average of any one operator or the lowest value for any single replicate for the official recovery percentage, the recovery values utilized will generally be higher.

The purpose of the Cleaning Memo is not to lock anyone into only one mode of swabbing. Rather the objective is to make clear some features of the use of multiple swabs that may help improve our design of swabbing procedures.