SafeBridge
CONSULTANTS, INC.

Guidelines for Air Sampling Analytical Method Development Validation

Analytical Laboratory

OBJECTIVE/SCOPE: These guidelines are used in designing experiments and planning the work that will be done to validate an analytical and sampling method for use in determining analyte concentrations in samples from Industrial Hygiene studies.

Validation covers:

- Analytical procedure
    1. Detection limit of the analytical procedure
    2. Precision of the analytical procedure
    3. Specificity
- Sampling procedure
    1. Extraction Efficiency
    2. Collection Efficiency
    3. Retention Efficiency
- Effects of Storage
- Overall quantitation limit for IH analytical and sampling method

A. ANALYTICAL PROCEDURE

1. **Detection Limit of the Analytical Procedure**
   The detection limit of the analytical procedure will be the amount of analyte that can produce a peak whose height is approximately 3 times the height of the baseline noise (reported as mass /ml).

2. **Precision of the Analytical Procedure**
   The precision of the analytical procedure will be measured as the coefficient of variation (relative standard deviation). It will be determined from 4 replicate injections of calibration standards analyzed in one run (INTRA-ASSAY VARIATION), and from 1 replicate of standards injected and analyzed on four different occasions (INTER- ASSAY VARIATION).

   Target values for replicate standards:

   a. Chromatographic Methods:
      i. %CV of ±10% (±15% at lowest limit of quantitation)

ii. % Recovery of 90-110% of nominal (85-115% at lowest limit of quantitation)

b. Immunoassay:(RIA, EIA, HPLC-RIA, etc.):
   i. %CV of ±20% (+25% at lowest limit of quantitation)
   ii. % Recovery of 80-120% of nominal (75-125% at lowest limit of quantitation)

3. Specificity

a. Analyze extracts from at least 3 replicates of independent spiked filters with concentrations equal to low, mid and high points on the calibration curve
b. Test also for possible interference coming from a blank, or from a sample spiked with an excipient blend.

B. SAMPLING PROCEDURE

1. Extraction Efficiency

Set of filters will be liquid spiked with an amount of analyte equivalent to:

a. The target concentration value, based on the recommended air volume
b. To the 10 % of the OEL
c. 100% of the OEL
d. 200 % of the OEL

Solvent used, as a diluent should be allowed to evaporate from the filter.

The filter will be extracted and the extract analyzed to determine the extraction efficiency. The analytical standards must be prepared with the same pipette used in spiking the extraction efficiency filters.

At least 80% of the analyte must be extracted.

The stability of extract will be determined by reanalyzing extract from sample that were spiked with the amount equal to the target concentration, one day after the extraction efficiency has been determined. The vials containing these samples should be resealed with new septa as soon as possible after the initial analysis. Freshly prepared standards must be used in the reanalysis. The results obtained will determine if restrictions must be placed on how long extracted samples may set before they are analyzed.

If storage instability is detected the analysis will be allowed until there is a 5 % loss of analyte.

2. **Collection Efficiency**
The collection efficiency of the filter for specified particle sizes can usually be obtained from the manufacturer's specifications.

3. **Retention Efficiency**
Set of filters will be liquid spiked with an amount of analyte equivalent to:

   a. 10 % of the OEL
   b. 100% of the OEL

A recommended flow rate would be selected that is suitable to the sampler and the recommended air volume drawn through the filters. (Usually it will be 100 and 500 l)

The air drawn through some of the filters should have a relative humidity of approximately 80 %

At least 80% of the analyte must be recovered from the filter and support pad.

For those substances that have a peak, ceiling, or short-term exposure limit, the limitations of taking a short-term sample (15 min, or shorter if feasible) at the recommended sampling rate should be determined. If a short-term sample at the recommended sampling rate is unfeasible, the use of a higher flow rate should be considered.

C. EFFECTS OF STORAGE

Set of filters will be spiked with an amount of analyte equivalent to:

   a. 10 % of the OEL
   b. 100% of the OEL

Each filter will be stored in the same type container (cassette, vial, etc.) that field samples will be stored during shipment to the Laboratory and prior to analysis.

The filters are separated into 2 equal groups with 1 group stored at room temperature for one week and the second under refrigeration at - 5 deg of C for three weeks. Storage areas must be dark.

D. OVERALL QUANTITATION LIMIT FOR INDUSTRIAL HYGIENE ANALYTICAL AND SAMPLING METHOD

The overall quantitation limit for IH method will be the smallest amount of analyte that can be quantitated by analytical method (with established detection limit) within the requirements of at least 80 % recovery and a precision of ±20% or better.

The overall quantitation limit will be reported as mass per sample with the equivalent air concentration based on the recommended air volume sampled, in parenthesis.

Comments and questions can be directed to:

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