

Bi-Air Guidelines

SAMPLING GUIDELINES FOR THE BI-AIR FILTER CASSETTE

Full Period Consecutive Samples: This is the preferred sample collection method according to NIOSH (NIOSH Sampling Strategy Manual, 1977). It samples the entire exposure period by collecting consecutive samples. The consecutive samples allow statistical calculations to be performed, and provide multiple samples if one sample is damaged or overloaded.

Full Period Single Sample: This is the second-best option. It samples the entire exposure period by collecting a single full-period sample. The single sample does not allow statistical calculations to be performed, and does not provide multiple samples if one sample is damaged or overloaded.

Partial Period Consecutive Samples: This is the third-best option. Several samples, of equal or unequal duration, are collected in series, but do not cover the entire period of exposure.

Grab Samples: Short-term (less than one hour) “grab” samples are collected at random times during an exposure period. This is the least desirable way of estimating airborne concentrations because of the high variability of the sampling data. However, this is the most common type of airborne sample collected in microbial IAQ investigations. Therefore, sampling results based on grab samples should be interpreted with caution since the typical 5-minute grab sample may either substantially underestimate or overestimate the average spore concentration. For example, if the geometric mean concentration were 1,500 spores/m³ and the GSD were 3, there would be a 5 % probability that a 5-minute sample would result in a reported concentration as high as 20,000 spores/m³ or as low as 200 spores/m³.

FILTER SELECTION

The Bi-Air may be loaded with any standard 25 mm filter, including MCE, polycarbonate, PVC, gel (for bacteria), etc. Bi-Air cassettes typically come loaded with mixed cellulose ester (MCE) filters having a pore size of 3.0 (um) microns. When using 0-5 lpm lo-vol pumps, for example, an MCE filter with a 5.0 um pore size may be used.

PUMP SELECTION

The Bi-Air has a large back pressure due to the small exposed area of filter; but the small area is necessary in order to allow sampling times as short as 10 minutes, when necessary. The maximum airflow rate through a 3.0 um MCE filter is about 3.7 lpm when using a hi-vol pump. However, the airflow rate through each filter will vary due to variations in thickness, and each cassette should be calibrated. For example, three cassettes attached to the same pump may calibrate at 1.5, 1.3 and 1.4 lpm (about $\pm 10\%$).

1. Hi-Vol pump: Airflow rates up to 3.5 lpm, for 10 min to 8 hours or more.
2. 0-5 lpm SKC Lo-Vol pump: maximum of 1.0 lpm, for 30 min to about 8 hours.
3. 0-12 lpm Buck Lo-Vol pump: Airflow rates up to 2.5 lpm for up to 3 hours.

Bi-Air Guidelines

Airborne: Fungal Spores or Culturable Fungi using the Bi-Air Cassette

Apparatus: Hi-Vol pump or 0-5 lpm Lo-Vol pump, Tripod, Cassette Support Plate, Tubing, 0-5 lpm rotameter, Bi-Air Cassette, Stopwatch, Sample bag, Field Sheet, Jeweler's Screwdriver, Marking Pen, Calibration Probe

Method 1: Hi-Vol pump at 2-3 lpm for 10 minutes to 8 hours or longer

- 01 Locate the tripod away from walls/obstructions
- 02 Attach a cassette support plate to the top of the tripod [available from Allegro]
- 03 Attach plastic tubing to one of the needle valves on the pump [available from EMS]
Using a Tee to install two needle valves on the pump allows multiple samples to be collected using a single pump; or allows cooling air to flow through the pump when sampling for extended periods
- 04 Attach a Bi-Air cassette to the tubing (resting on the support plate) & remove slotted cap
- 05 Calibrate the air flow rate using a 0-5 LPM rotameter with calibration probe attached
The calibration probe is a wall cavity probe with the perforations removed
- 06 Remove the rotameter, replace the slotted cap in the fully open position, and sample
The Bi-Air is unique in that the capture velocity may be varied independently of the sampling rate. When sampling outdoors in windy conditions, the slots may be partially closed to vary the capture velocity between about 4 mph and 24 mph.
- 07 Label = Project Number and Sample Number (A-01)

Method 2: SKC 0-5 lpm Lo-Vol pump at 1 lpm for 30 minutes to 6 hours

- 01 Set the Lo-Vol pump on a suitable surface (table, desk, etc.)
- 02 Attach a Bi-Air cassette to the pump using a short piece of tubing & remove slotted cap
- 03 Calibrate the air flow rate to about 1.0 lpm using a 0-5 LPM rotameter
- 04 Remove the rotameter, replace the slotted cap in the fully open position, and sample
- 05 Label = Project Number and Sample Number (A-01)

Method 3: Buck Basic 12 Lo-Vol pump at 1-3 lpm for 30 minutes to 3 hours

- 01 Attach leather or similar material to bottom of pump
The Buck Basic 12 will vibrate and "walk" off tables, etc.
- 02 Set the Lo-Vol pump on a suitable surface (table, desk, etc.)
- 03 Attach a Bi-Air cassette to the pump using a short piece of tubing & remove slotted cap
- 04 Calibrate the air flow rate to about 1.5 to 2.0 lpm using a 0-5 LPM rotameter
- 05 Remove the rotameter, replace the slotted cap in the fully open position, and sample
- 06 Label = Project Number and Sample Number (A-01)

REQUEST FOR ANALYSIS:

Sample Type = Air; Sample Media = Bi-Air; Quantity = Sample Volume per trace;

Units = L [liters]; Analysis: Trace A = Fungal Spores; Trace B = Fungi, (MEA & DG-18)

Bi-Air Guidelines

Airborne: Collecting Personal Samples using the Bi-Air Cassette

Apparatus: Lo-Vol pump, 1” piece of Tubing, 0-5 lpm rotameter, Calibration Probe, Bi-Air Cassette, Three-hole Insert, Stopwatch, Sample Bag, Field Sheet, Jeweler’s Screwdriver, Marking Pen,

Lo-Vol pump at 0.5 lpm for 15 minutes to 4 hours

- 01 Attach a Bi-Air cassette to the pump using a short piece of tubing & remove slotted cap
- 02 Label = Project Number and Sample Number (A-01)
- 03 Attach the calibration probe to the rotameter, place probe on cassette cowl
- 04 Calibrate the air flow rate to about 0.5 lpm
- 05 Remove probe and rotameter, put the 3-hole insert into the cowl (no slotted cap)
- 06 Attach the cassette in the breathing zone of the subject

REQUEST FOR ANALYSIS:

Sample Type = Air; Sample Media = Bi-Air; Quantity = Sample Volume per trace;

Units = L [liters]; Analysis: Trace A = Fungal Spores; Trace B = Fungi, (MEA & DG-18)

Bi-Air Guidelines

Wall Cavity: Total Spores and/or Culturable Fungi Using the Bi-Air Cassette

Apparatus: Lo-Vol pump, Tubing, 0-5 lpm rotameter, Bi-Air Cassette, Wall probe, Stopwatch, Jeweler's Screwdriver, Field Sheet, Portable Drill, 5/16" Spade Bit, Caulking, (White) Rubber Mallet, Marking Pen

Pumps = Lo-Vol pump or Hi-Vol pump

Sample time = 2-3 minutes [2 typical]; Flow rate = 1-2 liters per minute

Cassette = Bi-Air cassette with wall probe

- 01 Attach a Bi-Air cassette to the pump using a length of tubing & remove cap
- 02 Attach a 0-5 lpm rotameter to the front of the cassette using a calibration probe
- 03 Adjust the flow rate on pump to 1-2 lpm
- 04 Using a 5/16" spade bit, drill a hole through the wall covering (About 9" up from floor; or 9" down from ceiling; or thru the toe kick of a base cabinet) [CAUTION, DO NOT DRILL INTO PIPES OR CONDUITS]
- 05 Use the bit to push aside the fiberglass batt insulation inside the wall cavity
- 06 Attach a wall probe to the Cassette, and insert the probe into the hole as far as it will go, sealing the hole with the flared base of the wall probe, then tap on the wall surrounding the hole (about 5-6 times) [palm of the hand or rubber mallet] CAUTION, DO NOT USE A BLACK MALLET; OR, ENCLOSE IT IN A PLASTIC BAG - IT WILL MARK THE WALL]
- 08 Collect a sample for the first minute using a stopwatch, then tap on the wall again while collecting the second 1-minute of sample
- 09 Place the sealed Cassette and used Probe into a plastic bag, and seal the hole in the wall using the Caulk

REQUEST FOR ANALYSIS: Sample Type - Air; Sample Media - Bi-Air; Quantity - Sample Volume; Units - (L) liters; Analysis: Trace A - Total Fungal Spores, Trace B - Fungi, MEA & DG-18, Comments - "Dilution Plating"

COMMENTS: Dry media; do not refrigerate. Put cassettes, or Trace A from the cassettes, in a labeled plastic bag, and place in a shipping carton with the completed Request for Analysis.

ARCHIVING SAMPLES:

- 01 Open the cassette
- 02 Using tweezers, place the filter on a glass slide, and cut the filter in half
- 03 Place each filter half sample-side down on a glass slide, cover with a support pad, and secure with clear tape
- 04 Label the slides, shipping one set for analysis and archiving the second set

Bi-Air Guidelines

Carpet Dust: Culturable Fungi or Quantitative Polymerase Chain Reaction

Apparatus: Hi-Vol pump, Tubing, 0-20 lpm rotameter, 25 mm Sample Cassette, Mechanical Counter, Field Sheet, Marking Pen, Plastic Bag

Method 1: Culturing using a 25 mm open-face cassette

USE: Carpets & soft-surface furniture; for quantitative comparisons

Airflow rate = 10 liters per minute for 25 mm open-face (black) cassette

Spots per sample = 20

Sample time per spot = 5 seconds

- 01 Attach a closed-face cassette to the pump using a length of tubing
- 02 Attach a 0-30 lpm rotameter to the front of the cassette using plastic tubing
- 03 Adjust the flow rate to 10 lpm by adjusting the needle valve on the pump
- 04 Collect a 5-second sample from 20 different locations by holding the cassette firmly against the surface of the carpet or fabric at each location (do not move the cassette, press it firmly against a single spot for the 5 seconds)
(Estimate the 5-second period by counting)
(Keep track of locations sampled using a mechanical counter)
- 05 Cap the Sample Cassette and place it in a plastic bag
- 06 Label = Project Number and Sample Number

REQUEST FOR ANALYSIS: Sample Type - Dust; Sample Media - Cassette;
Quantity - Sample Area [98 cm²]; Units - 100 cm²; Analysis - Fungi, MEA & DG-18
Comments - "Vortex and Aliquot"

COMMENTS: Dry media; do not refrigerate. Put cassettes in a labeled plastic bag, and place in a shipping carton with the completed Request for Analysis.

Method 2: Spore counting using a Bi-Air cassette

USE: Carpets & soft-surface furniture when a fast turn-around is needed and QPCR is too expensive.

Airflow rate = 2.5 liters per minute

Spots per sample = 10

Sample time per spot = 5 seconds