

**U.S. EPA BASE STUDY  
STANDARD OPERATING PROCEDURE FOR  
COLLECTION OF BULK DUST AND  
BULK BIOLOGICAL SAMPLES**

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## 1.0 OBJECTIVE

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The objective of the procedure outlined below is to collect dust samples necessary to characterize the types and sources of dusts that may adversely affect the indoor air quality inside buildings.

Dust can have a significant impact on the health and comfort of building occupants. Of principal concern are those particles called “respirable” (approx. 0.1 to 5 microns in diameter) that may penetrate the respiratory tract, and those that on contact may irritate the skin and/or mucous membranes. Particles carrying allergens are also of particular interest.

The general term “dust” includes many different materials from different sources. Fibers may shed from building materials (acoustic tiles, insulation, carpets), spores and pollen may be introduced from outdoors or be generated by fungi growing inside the HVAC system, particulates may be dispersed from powders used in indoor operations (e.g., copiers, paper shredders), and dander, fibers, food particles, and general “dirt” may be introduced from the outside by building occupants.

Trapped or settled dust will, under proper temperature and humidity conditions, serve as substrate and nutrient for microbiological organisms. Some dusts (e.g., animal hairs and dander) introduced to the building by its occupants, may contain allergens.

## **2.0 GENERAL PROCEDURES**

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### **2.1 SAMPLING CRITERIA**

The bulk sample collection strategy involves sampling two areas, each associated with a different source of particulates.

Carpets are one area of interest. Mite or animal dander allergens are most likely to be found in carpets. A carpet may itself be a source of fibers and, under the right conditions, a substrate for the growth of microorganisms.

A second area of interest is inside the HVAC system. A convenient, and readily identifiable site is a cooling coil drip pan. Condensation most frequently occurs in this area, and growth of microbiological materials is most prevalent there. If water is found in the pan, the bulk sample is collected as a wet sample after first scrapping the surfaces under and around the water accumulation. If the drip pan is dry, scale and other deposits are scraped from its walls and the sample collected as a dry sample.

### **2.2 EQUIPMENT AND SUPPLIES NEEDED**

For collecting samples from carpets:

- Small vacuum (like Eureka Mighty Mite), with Aspirator tube modified with bolt and seals to support inserted thimble
- Plastic extension wand
- Cellulose extraction thimble (19x90 mm)
- Tygon tubing gaskets (3/16" to 1/4" sleeve from 20 mm ID/26 mm OD tubing)
- Ziplock<sup>®</sup> bags
- Butterfly binder clips
- Balance (0.01 g sensitivity)
- IADCS sample ID labels
- Isopropyl alcohol
- Parafilm

For bulk biological samples:

- Sterile disposable pipettes
- Sterile sampling bottles
- Ziplock<sup>®</sup> bags
- Whirl-paks
- Metal spatula for scraping and scooping sample
- IADCS sample ID labels
- Isopropyl alcohol

### **2.3 SAMPLING APPARATUS (FOR DUST COLLECTION)**

An approximately 3/16" to 1/4" long sleeve or gasket cut from 20 mm ID-26 mm OD Tygon tubing is placed around the mouth of the extraction thimble. The edges of the gasket and the thimble must lie flush against each other. A bolt, placed through two holes drilled on opposite sides of the aspirator tube and about 90 mm from its end, prevents the thimble from being sucked deeper into the aspirator tube. The holes holding the bolt are sealed with a suitable gasket to prevent air being sucked through them. An approximately 12-inch long wand (plastic extension tube) is placed over the end of the aspirator tube prior to sampling. A schematic description of the sampling assembly is illustrated in Figure 1 of Appendix A.

The thimble/gasket assemblies are prepared in a clean area and stored in individual air tight (Ziplock<sup>®</sup>) bags prior to shipment to the field. Each bag is tagged with an IADCS ID label.

### **2.4 SET-UP AND SAMPLING**

#### **2.4.1 Dust Sample Collection**

Dust samples are collected at each fixed site on the Thursday afternoon of the study week. Prior to sampling, the thimble/gasket assembly is weighed together with its Ziplock<sup>®</sup> bag. It is then removed from the sealed bag and glided into the aspirator tube so that the edges of thimble and gasket lie flush with the end of the aspirator tube. Additionally, prior to sampling the inside of each wand is swabbed with an isopropyl

alcohol soaked cotton swab and allowed to air dry. The ends of the wand are then covered with Parafilm until the time of sampling.

At each fixed site, the Parafilm is removed from the wand and the wand is then placed over the end of the aspirator tube, the vacuum cleaner is turned on. First, an area of approximately one half square meter is vacuumed for approximately 2 minutes and the amount of dust collected determined. Analyses for biologicals and allergens require a minimum amount of material and the area and time for vacuuming must be adjusted when necessary in order to collect sufficient material for analysis.

Approximately 0.5 to 1 g of sample, depending on the type of dust, is necessary to perform analyses for microbiologicals and allergens. The test for microbiologicals requires 30-50 mg of sample and the test for allergens 200 mg. However, for both tests the collected dust is first passed through a 425 micron sieve to separate coarse particles. Thus it is estimated that twice or more of the weight of material required for the analyses must be collected in the thimble.

If the amount of material collected under the specified "standard" conditions is insufficient, the area vacuumed and/or the time allowed for vacuuming should be increased. Vigorous vacuuming may be required under some circumstances. To ascertain that enough sample has been collected, the thimble is removed from the vacuum cleaner, resealed in its Ziplock<sup>®</sup> bag and weighed. If it is determined that the amount of sample collected is insufficient, the thimble is returned to the aspirator tube and vacuuming continued. This procedure is repeated until the desired quantity of sample has been collected.

To remove the thimble from the vacuum cleaner, the aspirator tube is turned upward before turning off the suction. Then the extension wand is detached and the thimble removed from the aspirator tube and placed in its Ziplock<sup>®</sup> bag.

Once a gram of dust has been collected, or an area of approximately 10 m<sup>2</sup> has been vacuumed (whichever comes first) the thimble/gasket assembly is removed, the gasket detached and placed inside the thimble, and the end of the thimble folded and closed with a butterfly binder clip over the bag on the outside. The clipped thimble is then

returned to the Ziplock<sup>®</sup> bag for shipment to the laboratory. (The gasket can be removed and the thimble closed without opening the Ziplock<sup>®</sup> bag).

NOTE: In some previous studies it has not been possible to collect a sufficiently large sample to conduct all the analysis prescribed in the BASE Protocol.

#### **2.4.2 Collection Of Bulk Biological Samples**

The number and type of bulk samples collected will vary from building to building from zero to five or ten. The investigator should perform a thorough inspection of the building HVAC system as well as within the study area to determine the number of bulk samples to be collected. Samples from materials within the study area exhibiting visual growth (such as walls and/or ceiling tiles) should be collected. In regards to the HVAC systems, samples should be collected in the cooling coil drain pan, system ductwork, humidification systems and the building cooling tower if so equipped.

Liquid samples are collected using a sterile disposable pipette. The liquid from the pipette is transferred into a sterile sampling bottle and labeled using the IADCS generated ID labels. Dry samples are collected using a sterile metal spatula. The spatula is used to scrape or scoop the sample from the sample site as well as in transferring the sample into a IADCS labeled whirl-pak container.

#### **2.5 SAMPLING LOCATIONS**

Dust samples are collected from the floor or carpet in the immediate vicinity of the indoor Fixed Sites 1, 3 and 5, specified in the BASE Protocol.

Bulk biological samples are collected from drip pans or other areas within the HVAC system where condensing or leaking moisture has collected. These samples may be collected at any point during the sampling week. However, samples must be collected prior to Thursday afternoon so that sample shipment can coincide with other sampling media.

### **3.0 QC SAMPLES**

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No QC samples are submitted for dust and bulk biological samples.

## **4.0 SAMPLE SHIPPING AND PROCESSING**

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A log book is kept to detail the exact sampling location as well as the conditions under which the samples are collected. For dust sampling, the vacuumed surface area is recorded on this logbook. This data will be transferred manually to the IADCS database.

Samples must be delivered to the laboratories within 24 hours of collection, as is specified by the BASE Protocol.

A documented chain of custody is required for all samples.

## **5.0 ANALYTICAL METHODS**

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The microbiological analyses performed consist of dilute culture for fungi and bacteria (mesophyllic and thermophyllic) with subsequent identification and counting of colony forming units (CFUs). Results of microbiological analyses are expressed as the number of CFUs per gram of sample.

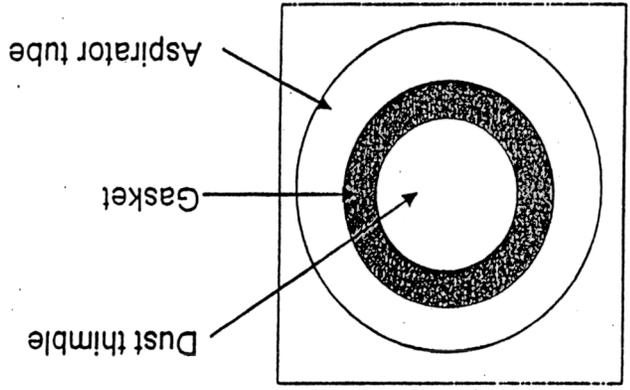
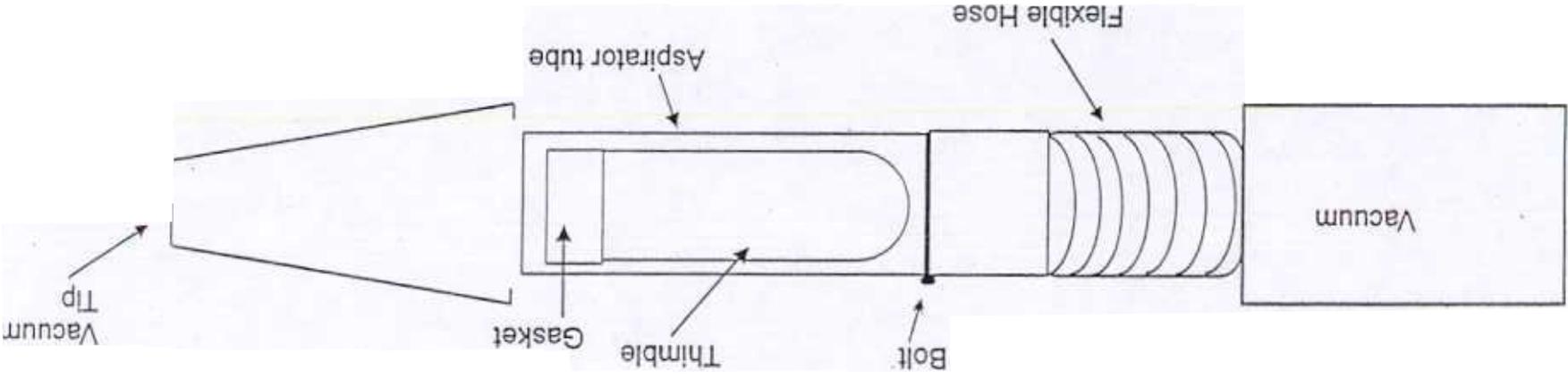
Allergens are extracted from the dust samples and identified by allergen specific immunoassays. The results of antigen analyses are reported in units of micrograms of antigen per gram of sample.

The laboratories performing the analyses must have demonstrated experience in the handling and analysis of environmental isolates.

**APPENDIX A**

**FIGURE 1  
DUST SAMPLING**

**Figure 1 Dust Sampling**



Cross section of aspirator tube and dust thimble: Tight fit is necessary