

HUD Office of Healthy Homes and Lead Hazard Control

VACUUM DUST SAMPLE COLLECTION PROTOCOL FOR ALLERGENS

For use by:

HUD's Healthy Homes Program Grantees

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Original by:
BATTELLE
(Version 1.0)

Revised by:
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(Version 2.0)

Acknowledgements:

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HUD Healthy Homes Grant Program Vacuum Dust Sample Collection Protocol for Allergens

1.0 Background

This protocol is intended for use by HUD's Healthy Homes (HH) grantees for collecting household dust samples for allergen analyses. Unlike traditional field sampling protocols, this protocol has flexibility built into it with the understanding that different grantees may have different goals and/or resource limitations that require a customized protocol to better suit their needs. As a result, some sections of this protocol describe a specific procedure to be followed whereas other sections provide different guidance options from which the grantees can select.

This protocol has been adapted from the April 30, 2004 (Version 1.0) using lessons learned from the 2006 American Healthy Homes Survey (AHHS). It incorporates procedures for the use of an integrated sample nozzle with removable filter collection sleeve that is being commercially sold as a sampling device for the collection of dust for allergens and other related analyses. Because the collection filters fitting these nozzles are small (typically about 60mm long by 15 mm in diameter), the dust holding capacity is also small. This size issue is a potential limitation in a household environment where animal (pet) hair is found. To combat this problem, this revised protocol includes monitoring the loading of the filter sleeve during sample collection and use of multiple filter sleeves (when needed) to complete sample collection of a selected area.

This protocol also includes the collecting surface area measurements combined with specific sample handling and extraction directives to the laboratory so that allergen-loading results (amount of allergen per surface area sampled) can be determined from laboratory reported results. Although most estimates on the effect thresholds are in concentration (such as mass of allergen per mass of dust), allergen-loading results provide a much better indicator of the amount available for exposure. Therefore, it is important to collect the surface area measurements and for the laboratory processing the collected dust sample to obtain a total sample mass (weight) after sieving the entire collected sample to 300 um.

2.0 Personnel Training

Sampling technicians should undergo a formal training program prior to beginning home visitations and allergen dust sampling. Grantees should document the names of those taking this training and where and when the training took place. Each grantee should devise a program-specific training program to cover the following areas:

- Overview of protocol and purpose
- Code of conduct in homes
- Orientation to data collection forms and appropriate completion
- Orientation to sampling devices to be used
- Handling of sampling materials
- Handling and transport of collected samples (valid and invalid samples)
- Troubleshooting of problems that are likely to be encountered

Sampling technicians must satisfactorily display proficiencies in the areas described above prior to being sent to the field. Before beginning the collection of the official samples for the program, technicians should practice the field-sampling protocol in several dry runs to become comfortable with it. In addition, a handbook should be created by the grantee outlining all of the information necessary to conduct successful field sampling of each housing unit. Copies of this handbook should be given to each sampling technician to use as a reference when needed.

3.0 Vacuum Sampling Materials and Supplies

Prior to visiting a housing unit, each sampling technician should be supplied with the following materials and supplies needed to conduct dust sampling:

USEAGE NOTE 1: It is suggested that you "stage" all of your field supplies (containers, gloves, labels, etc.) so that you have a standard box of supplies that will serve to collect all the samples you might need at one house or at one site. In this box, along with other sampling supplies, you can place a plastic bag containing the replicate labels that are planned for use at a given house. (See section 3-10 below).

- 3.1** Portable, canister-type vacuum cleaner with hose that will accommodate the selected collection nozzle (no battery operated or rechargeable models), fitted with new/clean vacuum bag.

USEAGE NOTE 2: Battery-operated or rechargeable models are not considered powerful enough to be effective for this sample collection. Vacuum bag is used as a safety measure to capture any dust that might pass through the sample collection filter. It is generally recommended that you have one spare vacuum bag for each vacuum (to use in the case that original becomes clogged or is inadvertently torn such as can occur if a wet area is sampled by accident).

- 3.2** Collection device: Either Type A (2.1 below) or Type B (2.2 listed below):

3.2.1 Type A. Two collection nozzles with small sample filter sleeve inserts (MiTest, Duststream or similar, see Figure 1). Place the collection nozzle itself in a resealable bag. Place each filter sleeve targeted for use in collecting dust samples into a hard walled sample container along with a filter cap (if available). Include one quart-sized resealable bag for holding together multiple samples collected for the same location (See Note 3).

3.2.2 Type B. Two of each type of vacuum attachments planned for use (floor or upholstery tool, as needed) along with a large disposable one-use "sock" filter sleeve per sample to be collected such as the type available from the Johns Hopkins DACI Reference Laboratory Asthma and Allergy Center [Dupont Hysurf Material: 1 micron exclusion disposable sampling bag, See Figure 2]. Place the vacuum attachments themselves in a resealable bag. Place each large disposable one-use "sock" filter sleeve into a hard walled sample container (See Note 4).

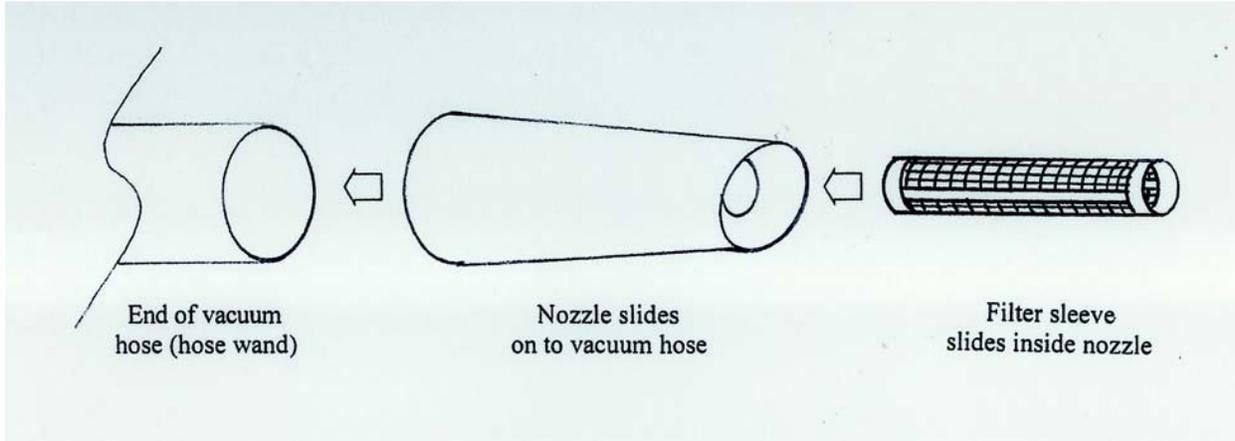


Figure 1. Example Diagram of Type A Collection Device

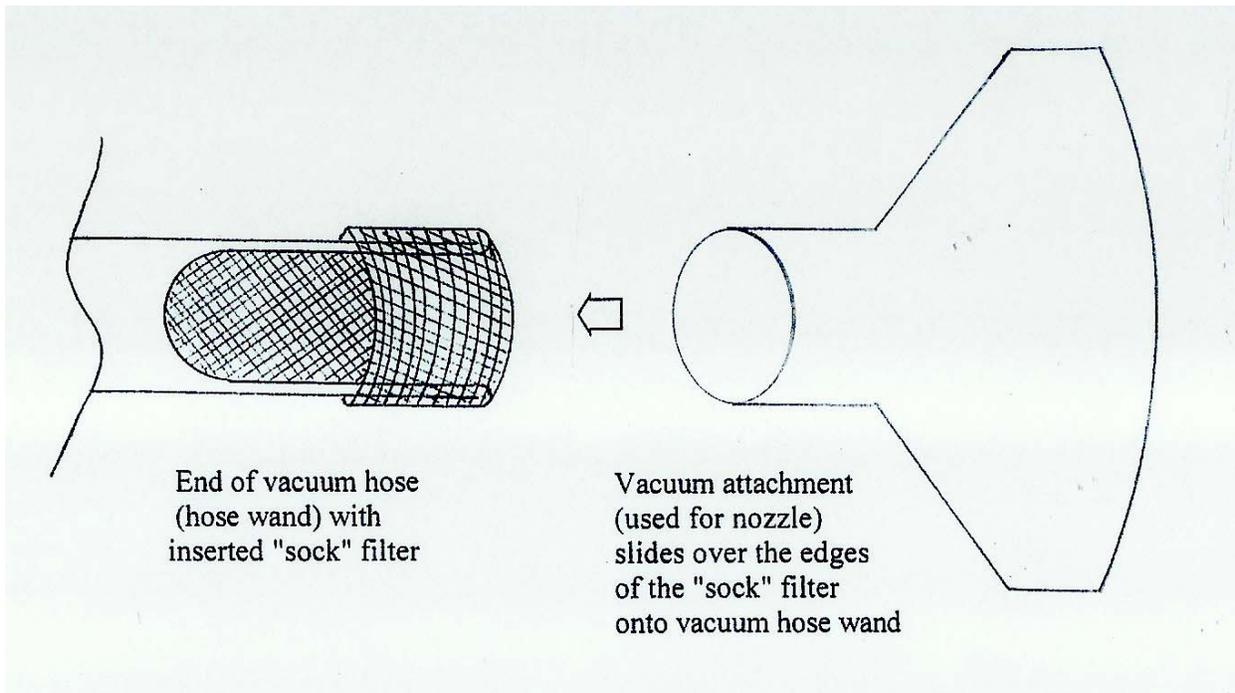


Figure 2. Example Diagram of Type B Collection Device

USEAGE NOTE 3: For Type A collection devices, it is recommended that you use 2 nozzles (per operator) so that one can be drying (after cleaning with a pre-moistened wipe) while the other is being used for collection. Otherwise you have to wait between samples (undesirable). The resealable plastic bag is NOT for holding the sample filters. Plastic bags should never be used to collect dust samples. Static cling is a serious problem when using plastic bags and you will likely lose sample if they are used. For hard-wall containers using Type A collection devices, we suggest using screw top centrifuge tubes big enough to hold the entire filter plus collected dust (50mL, 30mL or 15mL depending on the filter sleeve size). Type A collection devices generally have small filter sleeves. (Typically about 60mm long by 15 mm in diameter). Therefore, they will rapidly clog if you plan to collect samples in anything other than a fairly clean environment. Therefore, we recommend having at least 1 filter sleeve available (not necessarily used) for every 9 square feet (or 1 square meter) of surface collected (two should be considered for floors, while 1 is probably enough for sheets and relatively clean upholstery). This means that the total number of filter sleeves preloaded into hard walled sample containers needed onsite is dependent on the amount of surface area you plan on sampling. All filters that come from a specific sampling location must receive the same sample ID and the total number of sleeves collected for a sample should be placed on the field data collection form (Vacuum Dust Sample Collection Log). Multiple containers containing the used sleeves from the same sample location can and should be placed into a resealable plastic bag to hold them together. Therefore, all those samples inside the hard shell container within the plastic bag must have the same sample ID on them. Then, the lab is directed to combine (before sieving) all the dust contained in all the filters having the same sample ID (collectively stored inside the bag). The plastic bags are not a critical item, but it will help ensure that the lab combines all the collected filter sleeves that belong to one sample location. For example, if the lab misses one of the filters, you are never going to know and it will increase the variability of the pooled results in your study. Therefore, use the plastic bag to direct the lab as to which sample filter sleeves are to be combined for analysis.

USEAGE NOTE 4: For Type B collection devices, this protocol assumes that: (a) the disposable one-use "sock" filter sleeve is sufficiently large (approximately 6 inches long by 2 to 3 inches diameter) to capture all the sampled dust likely to be in selected sampling location without replacement; and, (b) the "sock" filter sleeve can be fitted into the vacuum wand (tube) of the vacuum as needed to collect the sample. It is recommended that you use 2 sets of attachments (per operator) so that one can be drying (after cleaning with a pre-moistened wipe) while the other is being used for collection. Otherwise you have to wait (undesirable). Avoid using attachments that have brushes in them, as these are hard to clean and could represent a source of cross-contamination between samples. For hard-wall containers, we suggest using screw top centrifuge tubes big enough to hold the entire "sock" filter plus collected dust (50mL should be big enough for most sample collection).

3.3. Extension cord (25 feet) with 2-prong adapter.

3.4. Box of disposable wipes for cleaning hands and sampling tools.

3.5. Non-sterilized, non-powdered disposable gloves.

3.6. Surgical booties (optional, as needed to protect residents floors)

USEAGE NOTE 5: The primary technical augment for booties is to prevent cross-contamination of material from one sampling site to another (whether in the same house or between houses). However, the downside to using booties is that they may alarm the residents. From a practical point of view, field staff must be trained to not walk over a sampling area until it has been sampled. Wearing booties does not protect the sampling site if walked on (the booties will pick up dust). Given that one should never be walking into an area where your feet are really dirty (or muddy), use of booties to cover shoes is optional. Use them if needed to protect the resident's floors from your (potentially) muddy feet.

3.7. Timer or stopwatch

3.8. Temperature/relative humidity gauge.

3.9. Vacuum Dust Sample Collection Logs (forms), clipboard and ink pens.

3.10. Sample labels.

USEAGE NOTE 6: It is suggested that you create a defined format for your sample IDs and to create pre-printed sample labels for use in marking sample containers and field forms. By creating them in advance of the fieldwork, you can ensure that all the numbers are truly unique and eliminate potential transposition errors in the field. Sample labels are easy to create using a spreadsheet that can be copied to a pre-formatted Word document (using matching commercially available label sheets). Be sure that your selected label fits on all the sample containers and sheets planned for use. It is generally recommended to create rows of labels with identical numbers on each row. That way one label can be used on the container, one on the field form, one on a chain of custody, etc. When using Type A collection devices, you will have to make a decision as to the maximum number of filters you are ever going to collect for a given location. If you end up using 4 filter sleeves for a single sample, you might need up to 6 identical labels (possibly more than one row of labels).

USEAGE NOTE 7: The sample ID format numbering system you select is somewhat dependent on the numbers and different types of samples you pan on collecting at a given house. Some researchers like to imbed a lot of information into the ID numbers and that can be useful. However, it is worth noting that there is a need to balance the size of the sample ID with the potential for transposition errors: the more complex the number, the easier it will be to make an error when keying it. Simple ID numbers that have a sequential order are useful because you can sort a set of data connected to those ID numbers and rapidly identify gaps in the data (and possibly missing samples). If you are collecting data from housing units, it can also be very useful to assign each house with a unique (base) ID number and each sample collected in that house is given a different sub number. For example, sample IDs X001-01, X001-02, X001-03 are the 1st, 2nd, and 3rd samples that are all collected from a house tagged X001. To use this scheme, all you have to do is label each "box" of supplies to be used at a house with a unique base number (like X001). Then be sure all the pre-

printed labels that you place in that box have that same prefix number. This way, you do not need to assign numbers in advance to the houses...they get assigned automatically by the box that is used for the sampling. Just be sure that the field staff is trained to label the box OPENED once they start using a box for sampling so that it never gets used again for another house.

3.11. Permanent marker

3.12. Low-tack painters tape (blue or green, 1/2 or 3/4 inch)

3.13. Measuring tape, 20 foot showing units in inches

3.14. Trash bags

4.0 Step-by-Step Sampling Procedure

The steps for taking dust samples within a room are as follows.

4.1. Locate area to sample. Upon entering the room to be sampled, establish an area for sampling on the designated components using a measuring tape and low-tack painters tape (if possible) to mark off the chosen area (for rectangular areas, not perimeters). Avoid disturbing or walking in area to be sampled. Avoid disturbing or walking in area to be sampled.

4.2. Plug in vacuum. Plug vacuum into a dedicated outlet and assure that the cord length will be long enough to reach the area to be sampled. Use an extension cord if necessary. Do not plug the vacuum into a circuit believed to be supplying electricity to an air conditioner or water heater. This will avoid overloading and tripping of the breaker or blowing of the fuse. If something must be unplugged in order to plug in the vacuum cleaner, try not to unplug electric clocks, computers that are in use, etc., and be sure to plug items back in after vacuuming is completed.

4.3. Check vacuum. Check to be sure a new vacuum bag is in the unit and that it is clean and not torn.

4.4. Don clean gloves. Put on disposable latex gloves. Booties are optional if shoes are dirty or muddy. If booties are used, they should be put on at the entrance doorway when first entering the house.

4.5. Connect nozzle (Type A collection devices only). Place a clean nozzle on the end of the vacuum hose (hose wand). Use blue painters tape if needed to ensure that the nozzle will not come off during sampling. All clean nozzles are stored in a resealable bag. After collecting a sample at a sampling location, clean the nozzle with pre-moistened wipe and allow to air dry before collecting the next sample or before storing it in a resealable bag. The vacuum can be used to help air dry the nozzle by pointing the nozzle upwards and allowing clean air to flow across it. Do not place a nozzle back into the resealable bag unless it is completely

dry. Do not clean the nozzle when switching a filled filter sleeve for an empty filter sleeve for a single sample location.

4.6. Insert/attach filter sleeve.

4.6.1 Type A collection devices. With the hose wand in the vertical position (pointing up) use a clean, gloved hand to insert the filter sleeve into the nozzle. Turn on the vacuum before pointing the nozzle down to the sampling location (or the filter may fall out).

4.6.2 Type B collection devices. With the hose wand in the vertical position (pointing up) use a clean, gloved hand to insert the "sock" filter sleeve into the end of the hose wand as needed to secure it inside with the edges of the sock overlapping to the outside of the hose wand and then slide on a clean vacuum attachment to hold it in place (see Figure 2).

4.7. Start sample collection. Begin vacuuming the specific sampling area established in the room. *See Section 5, subsections A-F* for specific details on sampling from selected components in designated rooms.

USEAGE NOTE 8: If large debris is encountered in the selected sample area, carefully remove the material by hand first so as not to clog the filter tube and adversely affect the collection of smaller dust allergen particles of interest.

4.8. Tilt the nozzle/vacuum attachment during collection and cover selected area twice. The efficiency of dust collection from a surface is directly related to the air velocity through the nozzle or vacuum attachment at the surface. For flat hard surfaces, no dust will be collected if the nozzle is completely pressed against the surface so that no air can flow. Technicians may have to tip the nozzle slightly to one side while they cover the sampling area so that air is always flowing across the nozzle or vacuum attachment. For surfaces that are porous, such as carpet or upholstery, the amount of the tilt should be reduced but there should still be a visible gap between the nozzle and the sampling surface. Move the nozzle across the sampling area to cover the entire area and then repeat the sampling in a direction perpendicular (90 degrees) to the original direction.

USEAGE NOTE 9: Many vacuum attachments are constructed with small ridges on the face of the attachment so that a gap always exists between the sampling surface and the vacuum attachment. For these types of "nozzles" the technician will not have to tilt the nozzle.

4.9. Complete sample collection:

4.9.1 For Type A collection devices: Change filters when full. While collecting dust, listen to the draw by the vacuum for subtle sound changes that might indicate a clogged filter. If you suspect the filter is full, note the stopping place on the surface being sampled and then point the hose wand in the vertical position (up toward the ceiling), turn off the vacuum and look into the end of the nozzle. If you cannot tell whether it is full, lean over the sampling location and use your gloved little finger to tease the filter out of the nozzle and examine it. If not full, push the filter back into the nozzle. If full, cap the filter (with the supplied cap, if any), place the filter into the hard shell container (where it came from) and re-seal that container, and insert a new filter into the nozzle. Turn on the

vacuum and continue where you left off making sure to vacuum up any dust that might have spilled out of the filter onto the sample location during your examination. Repeat this filter checking and replacement exercise as needed until either the entire sample location has been vacuumed or until the total maximum number of filter sleeves for use on a single location has been reached. In the case that the maximum number of filter sleeves is reached before completing collection at the selected sample location, mark the stopping point using a piece of tape and after storing the last full filter sleeve, measure and record the sample area that takes into account that the sample location was smaller than originally planned.

4.9.2 For Type B collection devices: Continue sample collection at the selected sample location until the desired sampling area has been reached. Point the hose wand in the vertical position (up toward the ceiling), turn off the vacuum and carefully separate the vacuum attachment from the wand at the junction where the filter sleeve is located. Hold down the edges of the "sock" filter sleeve against the wand to ensure that dust is not spilled when removing the attachment. Carefully fold the top of the sock filter to trap the dust inside and place the "sock" filter with dust into the designated hard-shelled sample container. Record the sample area.

4.10. Clean nozzle/vacuum attachment after collection. After collecting a sample at a sampling location, clean nozzle or the attachment and wand with pre-moistened wipe and allow to air dry before collecting the next sample or before storing it in a resealable bag. The vacuum can be used to help air dry the nozzle or the attachment and wand by pointing the nozzle/attachment upwards and allowing clean air to flow across it. Do not place a nozzle/attachment back into the resealable bag unless it is completely dry.

4.11. Label samples and record data. Label each hard-walled container that contains used filter sleeve that came from the same sample location with the same ID number. This ID number must be unique from all others from other sampling areas for a given research program. Record the sample ID, sample location, and sampled area on the Vacuum Dust Sample Collection Log along with all other needed project data (see example form at the end of this protocol). For Type A collection devices where multiple filter sleeves were collected for one sample location, place all the labeled hard-walled containers representing that sample into a single resealable bag.

4.12. Store sample. Place the labeled samples into a suitable container for short-term storage while completing the remaining work in the house. If you used a separate sampling materials box for each house, then this same box can be useful for holding collected samples until the house is completed. At the end of the sampling day, the samples should be relocated to a cool location such as a refrigerator, freezer or cooler. You do not need to put these samples immediately on ice after collection. But for any long-term storage (greater than 2 days), these samples must be stored either refrigerated or frozen to stop the microbial growth.

USAGE NOTE 10: The purpose to cooling the samples is to stop the microbial growth. Samples can be transported to a storage site or the lab without having to be kept cold provided that such transport does not involve an extended period of time (such as more than several days).

4.13. Record Collection Data. Complete required information on the Vacuum Dust Sample Collection Log for each sample.

4.14. Cleanup. Dispose of any trash generated in the supplied trash bags. No trash generated by the sampling may remain in the housing unit. All trash should be placed in supplied trash bags and properly disposed of off-site.

4.15. Check electrical. After collecting the sample(s) in a room, re-connect lamps or other electrical devices that were disconnected.

USEAGE NOTE 11: Avoid vacuuming wet or damp areas or collecting moist materials.

5.0 Dust Sample Collection Sites (Guidance only)

Table 1 provides a matrix of possible sampling sites within the selected household unit. As mentioned in the background section above, it is up to the grantee to determine the specific number of rooms and components to be sampled. The room(s) selected for sampling depends upon the project objectives. For example, the kitchen should be sampled if reduction in cockroach or mouse allergen loading is a major objective.

Table 1. Potential Rooms and Components for Dust Sampling		
Room	Surface	Sampling Area
Kitchen	floor	perimeter (wall/cabinet edge)
Common Living Area	sofa/chair or floor immediately in front of sofa/chair	rectangular areas
Bedroom	floor immediately next to side of bed most commonly used or bedding	rectangular areas
Basement (if present)	floor at bottom of stairs	rectangular areas

Allergen dust samples may be collected from the floor in one or all of the specified rooms (See Notes 12 and 13).

USEAGE NOTE 12: Collection of composite samples (more than one location sampled as a single sample) can be used to reduce analysis costs and field time. However, these gains are generally offset by reduced information that may not be suitable for some research goals and should only be done with care. For example, composite sampling of the floors between a kitchen and bedroom for mouse allergen may advertently assign a rodent risk to the bedroom when the real primary source of this allergen is in the kitchen where food is more often spilled. Additionally, in this example that assumes that mice are more often associated with kitchens, the true magnitude of the allergen in the kitchen is diluted from contributions from the bedroom.

USEAGE NOTE 13: It is important to ensure that enough dust is collected to meet all the analysis requirements for all the target allergens (as required by your laboratory). Differences in the cleanliness and surface floor type between different units can impact the amount of dust that is actually collected. Flexibility should be given to the technician conducting the sampling to expand the area of collection should the amount of dust being collected appear to be below that needed to meet the project needs for analysis. However, the technician should take care that such expansions of sampling area (when needed to obtain more dust) still represent the general locations of similar comparative sampling being done in different units. For example, if the target sampling location of 1 square meter on the floor in front of the couch or other most commonly used seat is the common living area, then a needed expanded area should still be centered around the target location.

The room and component combinations that may be sampled in a housing unit include the following:

5.1 Sampling Suggestions Common to All Room Locations: The following suggestions apply to all sampling locations:

- Use a new filter and clean nozzle for each separate sample collected.
- For type A collection devices, swap out filters as needed to collect dust from the entire surface area targeted for sample collection.
- Sample the designated area and record the collected area data and the sample surface type(s) in the Vacuum Dust Sample Collection Log.
- Sample for 5 minutes total.
- For floor samples, do not over sample cracks between floorboards and linoleum or tile. If there is a choice between sampling a rug, carpeting, or smooth floor, consider that the rug and/or carpeting likely will provide a much higher dust yield.
- For (non-perimeter) floor samples, collect rectangular samples and record the length and width dimensions of the sampled area in the Vacuum Dust Sample Collection Log.
- Record the room temperature and relative humidity in the Vacuum Dust Sample Collection Log

5.2. Kitchen Floor: Vacuum the entire perimeter of the kitchen (i.e., along base of walls, appliances, cabinets, etc.). If the counter is formed as a peninsula or island, vacuuming should follow the base of it as appropriate. Do not move appliances to vacuum behind or between them. Vacuuming should be performed for a minimum of 5 minutes. The perimeter of the floor area sampled (including all turns) must be measured to the nearest inch (or centimeter, if these units are used in the Log) and recorded in the Vacuum Dust Sample Log. The total sampled area is equal to the width of the nozzle times the perimeter length. The width of the nozzle must be measured to the nearest one-eighth inch (or millimeter, if these units are used in the Log) and recorded in the Vacuum Dust Sample Collection Log.

Suggestions specific to kitchen floor sampling:

- For perimeter floor samples in the Kitchen, sample the entire perimeter, including edges and around appliances. Push one edge of nozzle against wall while sampling. Record perimeter length sampled and the nozzle width in the Vacuum Dust Sample Collection Log. Do not sample inside cabinets and underneath refrigerators and other appliances.

5.3. Common living area floor: For this room, vacuum at least 9 square feet (or 1 square meter) of surface directly adjacent to a frequently used sofa (or chair) for 5 minutes total.

5.4. Common living area sofa (or chair): Collect a dust sample from the sofa (or chair) most often used in the selected common living area. Only upholstered sofas (or chairs) should be sampled. Vacuum the seat cushions, seat back, and arms of the sofa (or chair). Vacuum approximately 9 square feet (or 1 square meter) of upholstered surface. This typically corresponds to an entire chair, about ½ of a love seat, or about 1/3 of a sofa. If a cushion is present on a wooden or metal sofa (or chair), the cushion should be sampled. If the cushions within the targeted surface collection area are reversible, vacuum both sides. Also vacuum any throw pillows in the area. The sample should be collected for 5 minutes.

Suggestions specific to upholstery sampling:

- Sample designated area. Define a set of rectangular areas that add up to the total targeted sample area. Use low-tack tape to mark either the corners or the entire parameter of each area.
- Do not vacuum the area under the cushions or deep into the crevices of the sofa where large particles tend to collect.
- Record the dimensions of each and every rectangular area making up the total sample area in Vacuum Dust Sample Collection Log.
- Record the upholstery type in the Vacuum Dust Sample Collection Log.
- Sampling of upholstered surface may be performed in an alternate manner (e.g. sampling only seat cushions, not sampling pillows, etc.). If so, details of collection should be specified in an alternate protocol to be used by all technicians for sampling of sofa (or chair), and sampled surface area(s) should be recorded in sample log.

5.5. Bedroom Floor: For this room, vacuum at least 9 square feet (or 1 square meter) of surface directly adjacent to the side of the bed most often used by the resident for 5 minutes total. If possible, arrange the sampling area so that about one-quarter of the area to be vacuumed is under the bed. If this is not possible (i.e., because the mattress is on the floor, or objects under the bed prevent access), include as much of this desired area as possible under the bed.

5.6. Bedroom Bedding: Collect the bedding sample from the bed most often slept in. Occasionally, a bed may not be a conventional bed (i.e., it may be a couch or a pad). Sample these in a manner similar to a conventional bed. Handle all bedding layers with care and do not step on them. Occupants may be asked to assist in the sampling of the bedding. Vacuum all layers of the bedding (i.e., covers, blankets, top sheets, bottom sheet, mattress pad, “egg-carton” style pads, mattress, and pillows) for a total of **5 minutes**. Vacuum at least **2 square meters** of the bedding: if the bed is a single bed, vacuum the entire surface; if it is a double bed or larger, measure one meter width and vacuum down the length of the bed within the 1-meter wide area. The breakdown of the bedding sample follows:

1. **30 seconds** - one pillow (preferable the primary sleeping pillow) inside the pillowcase (if possible) without removing the pillowcase, and both sides of the pillow
2. **2.5 minutes** - all of the bedding layers described above.
3. **2 minutes** - mattress surface (impermeable, fully encapsulated mattresses should be sampled by vacuuming the top layer. Do not remove the cover).

Handle all bedding sensitively. Do not put it on the floor or in a place where it can get dirty or stepped on. Ask the family for assistance or suggestions, if necessary. Remake the bed as closely as possible to the way the family had it made up originally.

USAGE NOTE 14: Bedrooms are rooms that people sleep in on a regular basis. Rooms that are designed as bedrooms, but are being used for another purpose (e.g., as a guest room, office, playroom, sewing room, or storage room) are not included as bedrooms.

Suggestions specific to sampling bedding:

- The following items should not be vacuumed in the bedroom: stuffed animals, areas under the mattress, towels, and box spring surfaces.
- Rolled up blankets that serve as pillows should be vacuumed if they are on the bed at the time of sampling.
- To the degree possible, record total sample area in sample log.
- Record bedding layers sampled in the sample log.

5.7. Basement Floor: A finished basement also may be sampled at the discretion of the investigator. However, finished basements are generally considered as low priority locations for sampling for allergens. Suggestions for locating this sample include: the center of the largest open area of the floor or the floor at the bottom of the stairs. Wherever the sample is located, this information should be clearly defined in the final protocols used by all technicians collecting these samples. For this room, vacuum at least 9 square feet (or 1 square meter) of surface for 5 minutes total.

6.0 Dust Sample Collection Logs

Examples of three Dust Sample Collection Logs are provided in Appendix A: one for floors, one for upholstery and one for bedding. These are adapted from the dust sample logs used in the HUD sponsored National Survey for Lead and Allergens in Housing (completed) and the HUD sponsored American Healthy Homes Survey (nearly completed). These logs are intended for use in collecting a single sample in a specific room. The comments section of these example logs can be reduced and the space used to add other information that you may wish to collect on a room-by-room basis. When in use to collect an actual sample, the technician should make an entry in each and every block shown on these logs. If no comments are applicable, then the technician should make an entry of "no comment". Clarifications on the various entry blocks on the forms are provided in the front of Appendix A.

7.0 Shipping Samples to Laboratories

Collected dust samples should be stored cold or frozen until they can be batched together with an Allergen QC Sample (provided by HUD) and then shipped to the laboratory for processing and analysis (See Note 10). Because of the potential to inadvertently introduce moisture into collected samples, ice should never be used to keep collected dust samples cold. Allergen QC samples should be incorporated in with your collected field samples at a minimum rate of 1 per every 20 field samples.

8.0 Laboratory Processing Directives

Laboratories provide allergen results as a concentration by weight (amount of allergen per gram of dust). In order to determine a loading value (amount of allergen per area of surface collected), you must measure the area being collected and the total sieved weight of the entire collected sample. Obtaining this information is a key element often missing from laboratory processing of dust samples for allergen testing. Normally, the lab only extracts 100mg of the sample. The lab is not likely to extract the entire collected sample when the weight is larger than 100mg and they may not sieve the samples unless directed to do so. The only way to convert laboratory reported results (in amount of allergen per gram of sample) to a loading is to multiply the reported results by the total sieved sample weight and divide it by the collected sample area (see Note 13). The total sieved weight is desired because real-world dust samples often have a lot of larger material that will not be extracted into the solution the laboratory creates from the dust sample to perform the testing. Therefore, you must direct the laboratory to sieve the entire collecting sample and measure the sieved weight of the total sample that you collected in the field. If more than one filter is used to collect dust from a single selected location, then all the material in those filters must be combined and then filtered as one sample. If you follow the directives in this protocol, then the sample filters to be combined by the laboratory are all those that have the same sample ID and are grouped together in one resealable plastic bag. At the time this revision of this protocol was prepared, HUD is recommending to all grantees that they ensure that they give their lab a directive to sieve all submitted samples to 300 μm (Sieve Size No. 50), obtain and report a total sample mass (weight) along with the allergens results, and extract all (sub-) samples overnight with agitation before testing for allergens.

Chain of custody forms should be completed for all samples shipped to a laboratory in order to maintain of record of the parties responsible for the sample integrity at any given time and to provide a written record of the specific samples shipped to the laboratory for analyses. An example chain of custody form is provided in Appendix A.

USAGE NOTE 15: An example of converting ug/g to ug/square foot is: $A = [(B)(C)]/D$

where: A= results in ug per square foot
 B= results in ug/g
 C = total sieved sample weight in grams
 D= total sample collection area in square feet

9.0 Additional Suggestions

In addition to the protocol specifications outlined above, the following optional procedures might also prove useful.

Photographs. The taking of photographs might be helpful in later interpretation or to serve as a record in longitudinal studies where repeat measurements might need to be taken over time. If photos are to be taken, then a camera and supplies should be added to the grantee supply list for all sampling. Photos taken should be organized and adequately documented in order to ensure that they will be useful at a later point in time.

Site Plan. A site plan or drawing of the housing unit, including indications of sample areas and room measurements also may be useful in later interpretation or as a record for repeat measures over time in longitudinal studies. If a site plan is to be drawn for each housing unit then adequate supplies to measure and record such a rendering should be added to the supply checklist for each housing unit.

Appendix A - Example Vacuum Dust Collection Logs

Two example logs are provided in this Appendix: one for sampling dust from floors and one for sampling dust from upholstery. These forms each have 12 data entry blocks roughly arranged (top to bottom, left to right) in the likely order of completion during data collection. Also included at the end of this appendix is an example chain-of-custody log that may be used to track the custody of the samples from creation in the field to delivery to the lab targeted for processing the samples. When in use to collect an actual sample, the technician should make an entry into each and every data entry block on the forms. Clarifications for these 12 data entry blocks are provided below:

House ID. This is a unique identification (ID) for this house. Example IDs range from a full street address to an assigned sample ID number that is identified on some other project form.

Completed by. This is the name of the technician collecting the sample.

Date. This is the date when the sample was collected.

Sample ID. This is a unique identification (ID) for the collected vacuum dust sample. The block is sized to accept most sample ID labels.

Sample Collected? This is used to indicate whether a sample was collected and why not if it was not collected. If a sample is not collected, the technician should complete the header of the form (House ID, Completed by, and date), the "Room Location" block and circle "2" under the "Sample Collected?" block indicating that no sample was collected. They should also enter a code as to why the sample was not collected. Defined codes are shown at the bottom of the form. If none of the codes are suitable, the technician should create a new unique code and define it under the comments block of the form.

of Filters Collected for this Sample. This is used to indicate the total number of filters used to collect the entire dust sample at the targeted sample location. The laboratory may need this information to be sure that they know how many filters need to be combined together to process the entire collected sample. One method to transferring this data to the lab (other than sending the lab a copy of this form) is to note this number under the Comments column of chain-of-custody form that accompanies the sample to the lab.

Room Location Code. This is used to indicate which room was sampled.

Sample Surface Code. This is used to indicate the type of sampling surface.

Vacuumed Sample Area. This is used to indicate the dimensions of the sampled area. The form is currently setup for using inches (not meters, centimeters and millimeters). Use of these units reflects the more commonly available tape measures that can be purchased in the U.S and the fact that most U.S. residents think in terms feet and inches (not meters). Please note that only the dimensions of the sampling areas are recorded on the form and not the calculated sample areas. This is done because it is generally safer to avoid having

technicians do calculations in the field as the potential for introducing error increases, as the field efforts get more complex.

- For a perimeter sample, both the nozzle width and perimeter length must be recorded. The total sample area for a perimeter sample is the nozzle width times the perimeter length.
- For a typical rectangular floor sample, both the length and width must be recorded and the technician must be cautioned to be careful to make the corners as close to right-angles (90°) as possible. In general, most technicians are quite capable of getting the corners close enough to 90° using only their eyes as tools. The total sample area for a rectangular floor sample is the length times the width.
- For upholstery samples, the total sampling area is comprised of a series of rectangular areas. Therefore, there are multiple entries for recoding the length and width dimensions of each of these areas. The total sample area for upholstery samples is the sum of all the separate rectangular sample areas (sum of length times width of each rectangular area).

Room Temperature. This is used to indicate the room temperature. Allow the probe or measuring device to equilibrate (as required by the manufacturer) before taking a reading and avoid areas that are not representative of the temperature of the room (such as near a heating or cooling device).

Room Humidity. This is used to indicate the relative room humidity. Allow the probe or measuring device to equilibrate (as required by the manufacturer) before taking a reading and avoid areas that are not representative of the humidity of the room.

Comments. This block is used to record general comments about the sampling. In the case where there are no comments, then the technician should make an entry of "no comment". However, as a general rule, technicians should be encouraged to make comments about the conditions found and any other issue that could impact the validity or value obtained from the collected sample. Part of this space of the form can also be edited to hold questions aimed at obtaining relevant answers about the room being sampled. The questions asked are often project specific but may include the questions listed below in Table 2:

Table 2. Example Room Observation Questions			
Room Observations [circle one for each row]		Room Observations [circle one for each row]	
1 Mildew observed?	1=Yes 2=No	7 Evidence of rodents?	1=Yes 2=No
2 Other moisture evidence?	1=Yes 2=No	8 Room air conditioner?	1=Yes 2=No
3 Food debris observed?	1=Yes 2=No	9 Dehumidifier?	1=Yes 2=No
4 Evidence of smoking?	1=Yes 2=No	10 Air cleaning device?	1=Yes 2=No
5 Cockroach stains?	1=Yes 2=No	11 Humidifier/vaporizer?	1=Yes 2=No
6 Live/dead cockroaches?	1=Yes 2=No	12 Musty or moldy smell?	1=Yes 2=No

Vacuum Dust Sample Log for Floors

House ID:

Completed by:

on

(name)

(date)

Sample ID:

Sample Collected?:
[circle one]

Yes	1
No	2
If No, reason code: _____	

of Filters Collected for this Sample:

Room Location Code (circle one)
Kitchen.....1
Common Living Area2
Bedroom3
Other.....4
enter: _____

Sample Surface Code (circle all that apply)
Smooth/cleanable.....1
Not smooth2
Carpeted.....3

Vacuumed Sampled Area (Measure in units shown below)
<p>Perimeters only:</p> <p>Nozzle width: __ __ and __ /8 inches</p> <p>Perimeter length: __ __ __ __ inches</p> <p>Rectangular Areas only:</p> <p> __ __ inches X __ __ inches</p>

Room Temperature °F:

Room Humidity:

Comments:

No Reason Codes: I=Inaccessible, NO=Note allowed to sample, O=other: _____

Vacuum Dust Sample Log for Upholstery

House ID:

Completed by:

on

(name)

(date)

Sample ID:

Sample Collected?:
[circle one]

Yes	1
No	2
If No, reason code: _____	

of Filters Collected for this Sample:

Room Location Code (circle one)
Kitchen..... 1
Common Living Area 2
Bedroom 3
Other 4
enter: _____

Sample Surface Code (circle all that apply)
Leather 1
Plastic/vinyl 2
Velvet/velour 3
Woven Fabric 4
Other 5
enter: _____

Vacuumed Sampled Area (Measure in units shown below)
Rectangular Areas only:
_ _ inches X _ _ inches
_ _ inches X _ _ inches
_ _ inches X _ _ inches
_ _ inches X _ _ inches
_ _ inches X _ _ inches
_ _ inches X _ _ inches

Room Temperature °F:

Room Humidity:

Comments:

No Reason Codes: I=Inaccessible, NO=Note allowed to sample, O=other: _____

Vacuum Dust Sample Log for Bedding

House ID:

Completed by: on

(name) *(date)*

Sample ID:

Sample Collected?: Yes 1
 No 2
 [circle one] If No, reason code: _____

of Filters Collected for this Sample:

Room Location Code (circle one)
Kitchen..... 1
Common Living Area 2
Bedroom 3
Other 4
enter: _____

Sample Surface Code (circle all that apply)
Pillows 1
Sheets 2
Blankets 3
Woven Fabric 4
Other 5
enter: _____

Vacuumed Sampled Area (Measure in units shown below)
Rectangular Areas only:
____ ____ inches X ____ ____ inches
____ ____ inches X ____ ____ inches
____ ____ inches X ____ ____ inches
____ ____ inches X ____ ____ inches
____ ____ inches X ____ ____ inches
____ ____ inches X ____ ____ inches

Room Temperature °F:

Room Humidity:

Comments:

No Reason Codes: I=Inaccessible, NO=Note allowed to sample, O=other: _____

