National Human Exposure Assessment Survey (NHEXAS)

Maryland Study

Quality Systems and Implementation Plan for Human Exposure Assessment

Emory University
Atlanta, GA 30322

Cooperative Agreement CR 822038

Standard Operating Procedure **NHX/SOP-F04**

Title: Collection, Storage, and Shipment of House Dust Samples for Metal, Pesticide, and PAH Analysis

Source: Harvard University/Johns Hopkins University

U.S. Environmental Protection Agency
Office of Research and Development
Human Exposure & Atmospheric Sciences Division
Human Exposure Research Branch

1 Title of Standard Operating Procedure

Harvard University/Emory University/Johns Hopkins University Standard Operating Procedures:
F04 Collection, Storage, and Shipment of House Dust Samples for Metal, Pesticide, and PAH Analysis, Rev. 1.0.

2 Overview and Purpose

This standard operating procedure reviews the procedures for house dust field collection. The collection method uses a high volume small surface sampler (HVS3) for dust collection from the floor. The samples will be divided into two parts: one to be analyzed for metal content at HSPH, the other to be extracted by Southwest Research Institute (SwRI) for pesticide analysis by SwRI and PAH analysis by EPA NHEERL.

3 Discussion

Vacuum samples will be taken on the first visit of each Cycle. The high volume small surface sampler (HVS3) built by CS3 of Bend, Oregon, has a sampling train made from aluminum. For sampling pesticides, Teflon gaskets and tube connections are used. The HVS3 may be connected to normal household outlets. House dust more than 5 μm in diameter will be collected. Particles larger than 150 μm in diameter will be sieved out in the laboratory before analysis, as larger particles are less likely to adhere to skin or to be ingested inadvertently by the age group studied on NHEXAS (age 10 and up). Metals will be measured in units of μg/g. Pesticides and PAHs will be measured in units of ng/g. The area sampled will be recorded, so loadings can also be expressed as mass per square meter.

4 Personnel Responsibilities

4.1 Sampler Preparation and Maintenance

Teflon catch bottles will be acid washed at SwRI as per HSPH SOP L02 “Cleaning of Glass and Plastic Containers.”

Sampler preparation at the Field Coordination Center (FCC) is the responsibility of the FCC Supervisor (FCC-S).

The FCC Clerk is responsible for preparing Field Packets (including printing ID labels and affixing them to forms) before sampling.

4.2 Appointments and Reminders

Making appointments and sending reminder letters are the responsibility of the FCC staff.

4.3 Sample Collection

Sample collection is the responsibility of the Field Technician 2 (FT2) with some assistance by the Field Interviewer.

4.4 Storage

Immediate storage of the sample prior to return to the FCC is the responsibility of the FT2. Custody will be turned over to the Field Coordinator (FC) or his designate for storage.

4.5 Shipment

Shipment to SwRI for sieving and division is the responsibility of the Field Coordinator or his designate.

The FCC Clerk is responsible for copying and filing forms, and shipping forms and samples.

SwRI is responsible for shipping the metals fraction to HSPH for extraction, and for shipping a fraction of the extract to EPA NHEERL for PAH analysis.

4.6 Sieving and Division

Sieving and division of samples is the responsibility of SwRI.

5 Required Equipment and Reagents

5.1 Field Coordination Center (before field sampling)

2 catch bottles, Teflon FEP, wide mouth, 8 oz./250 mL capacity, Nalgene (Cat no. 2100) or equivalent, acid washed
transparent tape
scale
plastic bags, sealable, 1-quart (about 6" x 10", to hold catch bottle)

5.2 Field Sampling

tape measure, approximately 25 feet long (8 m), Craftsman 1" wide recommended
floor sampling template (made of cloth measuring tapes) with 1-m^2 inner area
masking tape
high volume small surface sampler (HVS3)
HVS3 sampling train (tubing and nozzle, in plastic bag, separate set for each house)
HVS3 maintenance record (kept with sampler)
heavy duty extension cord, at least 25 feet long
3-prong outlet adaptor
tools: screwdriver, wrench
Magnehelic gauges, flow and 0-1.0 inch
wipes, Kimwipe or equivalent
"Royal Micro Fresh" filter bag for HVS3 (spare bag)
2 250-mL Teflon catch bottles with caps, acid washed, in bags (section 6.1)
disposable unpowdered lead-free latex gloves
clear plastic tape, 1-1.5" width
cooler with cold packs
field decontamination kit: large tray or pan; brush; methanol (pesticide grade) in 500-mL plastic squeeze bottle; jar for waste methanol

5.3 Sample Tracking and Paperwork

16 sample ID labels with sample type 21 for "dust--field sample": 3 for FCC logsheet, 3 for field logsheet, 1 for chain-of-custody form, 1 for floor plan, 2 for sample containers, 6 spares
8 sample ID labels with sample type 22 for "dust--metals"
8 sample ID labels with sample type 23 for "dust--pesticides/PAHs"
8 sample ID labels with sample type 24 for "dust--storage"
8 sample ID labels with sample type 25 for "dust--field spike"
Field Packet for household: FCC and field logsheets (3-part carbonless), chain-of-custody form
Field Manual (SOPs)
clipboard
pens, ballpoint, 2 black or blue for logsheet, plus (in Cycles 2-8) 2 red or green for writing on the copy of the floor plan (to distinguish new writing from old)
floor plan sheet
(Cycle 1: blank sheet; Cycles 2-8: photocopy of floor plan from previous Cycle)

6 Procedure

6.1 Preparation for Collection

6.1.1 Assembly, Calibration, and Maintenance of HVS3

The FCC Supervisor is responsible for assembly, calibration, and maintenance of the HVS3. S/he will record assembly, calibration, and filter bag changes on the maintenance record sheet that is kept for each HVS3.

Assembly: The HVS3 will be assembled before Cycle 1, and kept assembled. For assembly instructions, see section 3.4 of the HVS3 Manual (attached).

Calibration: A full flow calibration should be done a minimum of once a year. For the NHEXAS pilot study, which lasts 15 months, the units will be calibrated before Cycles 1 and 5. For directions, see the HVS3 Manual, section 3.3. Zero the gauge in the position in which it will be used.

Filter bag: Bags will be changed every two weeks as preventive maintenance. In the field, if the flow rate cannot be adjusted for sampling, change the bag and record the change on the maintenance record.

6.1.2 Reminder to Respondent

FCC staff will send a reminder letter to the respondent about the sampling appointment at least ten days ahead of the appointment. Include instructions that respondent refrain from vacuuming for at least two days prior to sampling. Record your name and the date on the FCC logsheet.

6.1.3 Identification Labels

The FCC Clerk will:

- Print ID labels and inspect them to make sure that they are correct for the household, Cycle, and sample types.
- Affix a “type 21" ID label to a chain-of custody form and check the “21" box on the form.
- Affix 3 identical labels to the three parts of the FCC logsheet, and 3 identical labels to the three parts of the field logsheet.
- Affix a “type 21" ID label to the floor plan sheet. If this is Cycle 1, place the label in the box. If this is a later Cycle, place the label covering the label on the photocopy.
- Affix ID labels of types 22, 23, 24, and 25 to four chain-of custody forms. Check the corresponding box on each form. Place the other type 22, 23, 24, and 25 labels in a plastic bag, seal the bag, and clip it to these four chain-of-custody forms.
- Record your name and the date on the FCC logsheet.
- Assemble the Field Packet for the household.

6.1.4 Daily Maintenance of HVS3

At the FCC after sampling, the FCC-S will:

- Place any unused catch bottles in a designated storage area to be relabeled.
- Feel the filter bag. If it feels almost full, change it and record the change on the maintenance record.
- Decontaminate nozzles and tubing, using alcohol with wipes and brushes (see section 6.3.4).
- Record your name and the date on the FCC logsheet.

6.1.5 Teflon Catch Bottle

Bottles will have been acid washed by the method described in HSPH SOP L02 "Cleaning of Glass and Plastic Containers." At the FCC, FCC-S will:

- Put on lead-free latex gloves.
- Cut transparent tape long enough to go around a bottle with some overlap. Wrap it around the bottle near the top.
- Affix an ID label to the tape on each bottle: sample type 21.

- Place each bottle in a plastic storage bag with 3 spare ID labels and seal the bag.

- If there are clean bottles that were taken to the field but not used, remove the labels and treat them like new clean bottles.

6.1.6 Transfer and Inspection of Equipment

At the Field Coordination Center, FT2 will:

- Check the FCC logsheet to make sure that all preparation has been done. File the logsheet in the folder for the household and Cycle.

- Make sure that all paperwork is present and that the ID labels are correct. Pack the tote boxes to go to the field.

6.2 Selection of Sampling Locations

One floor dust sample will be collected from the activity room of the household.

6.2.1 Cycle 1

The Interviewer will ask the respondent which room is the activity room. (This is the room where the most household activity takes place, usually the room with the television.)

The Field Technician 2 will:

- Check "Cycle 1" on the logsheet.

- Choose a sampling area in the activity room that:
  → is in the main footpath or play area
  → is accessible by the HVS3 apparatus
  → is at least 1 meter from an outside door
  → does not require moving furniture
  Areas with carpet or rug are preferred, but hard floors are acceptable.

- Sketch a floor plan of the household with measurements. (It does not have to be exactly to scale; see example.) Note all significant features, but especially the location of windows, doors, and the area sampled. The exact location of the sampling area should be measured and documented so that the sampling area may be identified and located again in the next Cycle.

- Consult with Field Technician 1 about where the indoor air sampler will be placed. Mark this location on the floor plan sheet as (A).

- Choose the area to be sampled and measure the distances from two walls. On the floor plan, sketch the location of the area and record the sampling location and type(s) of floor covering.

6.2.2 Cycles 2-8

- Look at the photocopy of the floor plan from the previous Cycle. Note any changes, e.g. furniture moved onto the previous location.

- If it will not be possible to sample in the same location as before, write on the floor plan in red or green ink the date, the reason for changing location (e.g. a carpet was removed, so another area with carpet was chosen), and the new sampling location.

- Check the appropriate box in the "location sampled" section of the logsheet. Write comments if appropriate.

6.3 Sample Collection Procedure

6.3.1 General

- One floor sample will be taken in each home. For this section, refer to the diagram of the HVS3 (page 6) and the parts list (page 7) in the HVS3 Manual.

- Place the template on the area to be sampled and secure it with tape.

- Notice the cleanliness of the surface to be sampled. Record this information on the logsheet with any appropriate comments. Cleanliness and type of surface will affect how much area must be sampled.

- Put on gloves.

6.3.2 Pre-Sampling Checks

At the residence, the FT2 will:

6.3.2a Leak Check (section 4.2 of HVS3 Manual)

- Seal the inlet tubing by placing the back of the clipboard across the end. Turn on the HVS3 with the switch at the top of the handle. The flow Magnehelic gauge should read between 0-0.02 inches of water. If a good reading cannot be achieved with the flow Magnehelic gauge, use a 0-1.0 inch Magnehelic gauge.

- If the gauge reads more than 0.02 inches of water, check that all connections of gauge tubing are correct.

- If all tubing is connected properly and the flow through the system still exceeds 0.02 inches of water, check all gaskets and tightness of clamps, catch bottle, and the plug sealing the inlet tubing.

- When the flow reading is acceptable, record it on the logsheet as "leak check."

6.3.2b Setting Nozzle Pressure Drop [section 5.2 of manual]

- Clean the nozzle lip and plastic wheels with a wipe and alcohol.

- Place the sampler in the lower left corner of the sampling area. Adjust the flow rate and pressure drop according to the surface. The two factors that affect the efficiency of a sampling system are the flow rate and the pressure drop at the nozzle. The pressure drop at the nozzle is a function of the flow rate and the distance between the surface and the nozzle flange.

- Pressure drops and flows will change as you use the sampler. Try to keep the average values at least equal to those in Table 1. Slightly higher is better than slightly lower.

Table 1 -- Flow Rate and Nozzle Pressure Drop (cfm = cubic feet per minute)

Surface	Flow Rate		Nozzle Pressure Drop (in. water)
	cfm	in. water	
Carpet, level loop	16	5	10
Carpet, other (plush, multilevel, shag)	20	8	9
Hard (wood, tile, etc.)	20	8	9

- To regulate the nozzle position, use the height control knob on the back of the HVS3 and the nozzle level adjustment knob on the front of the nozzle. (See Figure 5-3 on page 15 of the HVS3 manual.)

- To regulate the flow rate, use the butterfly valve on the control tube on the downstream side of the cyclone. The flow is measured by the pressure drop across the cyclone. The higher the flow, the higher the pressure drop.

- On level loop carpet:

  → Adjust the height of the nozzle until the bubble level is centered. If the HVS3 is close to the position required but the nozzle bubble is not centered, use the leveling knob on the nozzle.

  → Once it is leveled, set the flow rate with the butterfly valve. Check the flow rate on the Magnahelic gauge.

  → Tip the HVS3 forward for a few seconds so that the carpet will seal to the nozzle. Set the flow so that the Magnahelic gauge reads 5".

  → Read the pressure drop across the nozzle. It should be approximately 10". If it is not, recheck the flow and/or check that the nozzle is still level.

→ Write the flow reading on the logsheet as "system flow rate."

- On other carpet (plush, multilevel, shag):

  → Read the pressure drop across the nozzle. Set the pressure drop at approximately 9" on the nozzle gauge by using the height adjustment knob and the level knob to keep the nozzle level.

  → Check the flow rate. Use the butterfly valve to set it at about 8".

  → Check the pressure drop across the nozzle again. It will have changed from 9" because of the increased flow rate, which increased the pressure drop across the nozzle and vice versa.

  → Set the nozzle pressure drop to 9" again, using the height adjustment.

  → You will probably need to make a few small adjustments three or four times until it is set right. It need not be exact. The flow rate should be between 8" and 9", and the nozzle pressure drop should be between 9" and 9.5".

  → Write the flow reading on the logsheet as "system flow rate."
  [record nozzle pressure drop?]

- On a hard floor:

  → Set the height of the nozzle above the floor at approximately 1 mm. (A U.S. penny should barely fit under the nozzle lip.)

  → Adjust the flow rate to between 8" and 9". The nozzle pressure drop should be between 9" and 9.5".

  → Write the flow reading on the logsheet as "system flow rate."

- If the correct pressure drop cannot be reached or the nozzle leveled, change the position of the nozzle by loosening one of the clamps on the 1" φ (diameter) tube and adjusting the nozzle.

- If the carpet is thin and the vacuum sucks it up, open the butterfly valve and readjust.

- If the flow rate cannot be adjusted for sampling, change the filter bag. Record the change on the maintenance record sheet.

- Check that the lever at the bottom is in the notch next to the lowest, so that the handle is at a 45' angle with the floor. With the handle at this angle and a firm downward pressure, the HVS3 is much less likely to nosedive.

6.3.3 Sample Collection

- Begin sampling by moving the nozzle forward and back along the left edge of the area marked by the template, covering an area 7.5 cm (3") wide and 1 m long. Vacuum this area 8 times (4 back-and-forth passes). Move the sampler at about 0.5 m per second, so it should take 2 seconds to travel 1 m. Move in a straight line between the numbers on the tape.

- After 4 back-and-forth passes on the first strip, gradually angle over to the next 7.5 cm wide strip and repeat 4 back-and-forth passes. Repeat until you have sampled about half the area of the template.

- When you have sampled about 0.5 square meter (less if the area is very dirty), turn the vacuum off and check the amount of collected material in the catch bottle. (Don't count hair and fluff.)

  → If it appears that approximately 6 mm (1/4 inch) of material has been obtained, stop vacuuming. Calculate the area sampled by noting the width of the cleaned area on the measuring tapes. An area 1 m by 53 cm is 0.53 m^2. Record the area on the logsheet.

  → If less than 6 mm of material has been obtained, vacuum the rest of the 1-m^2 area and check the bottle again.

  → After vacuuming 1 m^2, if less than 6 mm has been obtained, mark off another 1-m^2 area next to the first and vacuum it. When enough material is collected, record the area on the logsheet.

  → If the bottle is more than 25% full, or if material in the bottle swirls near the top of the bottle when the vacuum is on, take the bottle off and cap it with its own cap from the plastic storage bag. Secure the bottle cap with clear tape. Place the bottle in its plastic storage bag and place it in the cooler with cold packs. Record the number of bottles used on the logsheet. Install a new bottle and continue sampling.

- When you have enough dust, turn off the HVS3 and record the area sampled.

- Unscrew the catch bottle and cap with its own cap from the plastic storage bag. Secure the bottle cap with clear tape. Place the bottle in its plastic storage bag and place it in the cooler with cold packs.

- If there is not a clean sampling train for the next residence, decontaminate the used sampling train as in section 6.3.4.

- Remove the gloves and discard them in the trash bag.

- Check the logsheet and fill in any missing information.

- Pack away the tubes and nozzle in the large plastic bag.

- Return the equipment to the FCC. Transfer custody of the catch bottle and sample to the FC. Place the HVS3 equipment in a designated area to be checked and decontaminated.

6.3.4 Decontamination

Normally there will be a separate clean sampling train for each residence; the FCC-S will decontaminate them after they are returned to the FCC. If there is not, or if parts from the second set have been used because of loss or breakage, the FT2 will decontaminate them before entering the next residence.

FCC	Field
Do all steps in the area of the FCC designated for cleaning equipment; this area is well-ventilated and free from dust.	Do the next step at the residence that has just been sampled.

- Wear gloves. After removing the sample bottle, open the butterfly valve to maximum flow, tip the sampling train back so that the nozzle is 2" off the surface, and switch on the HVS3.

- Place your hand over the bottom of the cyclone and alternate closing and opening the cyclone for 10 seconds to free any loose material adhering to the walls of cyclone and tubing. It is not necessary to catch this small amount of material.

FCC	Field
Do all steps in the area of the FCC designated for cleaning equipment.	Remove the gloves and discard them in the trash bag. Do the rest of the process in a well-ventilated area that is free from dust; the back seat of your car may be the best place. Put on new gloves.

- Remove the cyclone cone, bellows connector, and elbow at the top of the nozzle tubing from the sampler.

- Use the brush supplied with the HVS3 to clean the nozzle, bellows connector, elbow, and cyclone with methanol. Clean each part separately, rotating it so that each internal surface is washed and brushed three times. Alternate between applying methanol with the squeeze bottle and brushing.

- Inspect each part to be sure that there is no visible trace of dust. If any dust is visible, wash the part again.

- Wipe the wheels clean and cover them with solvent-rinsed foil to prevent tracking in dust.

- Pour the used methanol into the waste jar and cap it securely.

FCC	Field
When all parts are clean, place them in a dust-free place to dry for at least 30 minutes. When they are dry, pack them in a large plastic bag.	When all parts are clean, dry them as well as possible with wipes and put them into a clean plastic bag. At the next residence, assemble the sampler, turn on the vacuum cleaner, and draw air through the sampling train for at least 5 minutes before beginning sampling.

6.4 Labeling of Samples

A unique ID number will be assigned for each sample (see SOP "G03 Identification Numbers for Samples and Forms"). Printed labels will show the ID number in bar-code and human-readable format. The Field Technician will affix identical labels to the sample container, to the logsheet, and to the Chain-of-Custody form.

6.5 Preservation and Storage

At the Field Coordination Center, the Field Technician 2 will:

- Transfer custody of the sample bottles and the logsheet to the Field Coordinator. The FT and FC will sign the chain-of-custody form to record the transfer.

The Field Coordinator will:

- Keep the samples in a refrigerator in a locked room at the Field Coordination Center until shipment for division.

6.6 Handling and Shipping

Samples will be shipped to SwRI for division twice a week by overnight delivery; see SOP G05 "Storage and Shipping of Samples." They will be packed in a cooler with cold packs; the cooler will be packed with adequate bubble-wrap or other cushioning material.

After division, samples and extracts to be analyzed for pesticides or PAHs will be shipped with dry ice. Samples and extracts to be analyzed only for metals do not need dry ice or cold packs if they are shipped, but will be packed with adequate cushioning material.

6.7 Laboratory Analysis

6.7.1 Division of Samples

At SwRI, samples will be weighed, sieved, and divided into four fractions (if there is enough dust): one for HSPH to be extracted and analyzed for metals, one for SwRI to be extracted and analyzed for pesticides and PAHs, one for field spikes, and one for storage. See HSPH SOP L05 “Sieving and Division of Dust and Soil Samples.”

6.7.2 Metals

Samples will be prepared at HSPH using EPA Method 200.8 as a guideline. This will involve extended digestion in one or more concentrated or diluted mineral acids followed by a dilution to an optimal volume for analysis by either GF-AAS or ICP-MS or both. See HSPH SOPs L06 "Extraction of Metals from Sampling Media," L07 "Analysis of Metals by GF-AAS, and L08 "Analysis of Metals by ICP-MS." Any analyses by another laboratory will be done according to EPA Method 200.8 or a documented equivalent.

6.7.3 Pesticides and PAHs

Samples will be extracted at SWRI and analyzed for pesticides (at SwRI) and PAHs (at EPA NHEERL). See HSPH SOPs L11 "Extraction of Neutral Pesticides and PAHs from House Dust and Soil" and L14 "Determination of Pesticides, Acid Herbicides, and PAHs by GC/MS."

6.8 Data Workup

Field and laboratory data will be returned to Harvard in both magnetic and hardcopy format. Data will be coded and checked, computer entry verified, and discrepancies resolved. Analytical results will then be merged with questionnaires and other data, using the ID number as the merge parameter.

6.9 Sample Tracking

The ID number will allow tracking of each sample. A data base management system will ensure knowledge of the status and location of any sample at any time including retrospectively.

The Chain-of-Custody form will accompany samples through all transactions. Anyone who receives, transfers, or ships samples will sign and date the form, and keep a photocopy. It must clearly contain all necessary information so that the custody of the sample can be determined at any time. Airbills, bills of lading, etc., are acceptable substitutes when a commercial or government carrier is used; copies of such bills will be attached to the chain-of-custody form.

7 Quality Assurance Procedures

7.1 Laboratory and Field Blanks

7.1.1 Laboratory Blanks

Laboratory blanks will be prepared and analyzed according to the schedule set up by the laboratory, and the laboratory quality assurance measures as outlined in the extraction and analysis SOPs. See section 6.7. ASTM or NIST standard dust blanks may be used.

7.1.2 Field Blanks

Field blanks will be collected once a week to determine whether additional dust is left in the system. They will be staggered on a schedule that balances with other sampling schedules to assure that the respondent subject to field blank sampling will not be adversely affected by the amount of time needed to take field blank samples for multiple media.

Field Technician 2 will take field blanks as follows:

- Prepare a clean catch bottle with the last digit of the ID number different from the sample bottles.
- Write "BLANK" on the logsheet.
- Before taking a sample, install the clean catch bottle on the HVS3. Hold the back of the clipboard against the end of the nozzle and run the vacuum for 60 seconds.
- Remove the bottle, cap and tape it, seal it with tape, and place it in the cooler with cold packs just as for a sample bottle.

7.2 Duplicate Sampling

Duplicate sampling will be carried out in 10% of residences. The FCC Clerk will:

- Print labels with the ID number the same as for the primary sample bottles for the same residence, except that the last digit R = 2.

Field Technician 2 will take duplicate samples as follows:

- Affix ID labels to two clean catch bottles. Use the same labels for a logsheet and chain-of-custody form. Write "duplicate sample" on the logsheet.
- After taking the primary sample and removing the catch bottle, disassemble the tubes and nozzle. Use the brush to loosen dust adhering to surfaces. Turn on the vacuum and block each opening in turn. Turn the vacuum off and inspect the surfaces. Repeat if necessary.
- Take samples as for the primary sample. Choose areas adjacent to previously sampled areas if possible, otherwise as close as possible. Mark the areas on the floor plan, labeled "duplicate."

7.3 Tolerance Limits, Detection Limits, and Sensitivity Limits

The tolerance limits, detection limits, and sensitivity limits for the method will be determined through analysis of blank and replicate analytical measurements.

The table below shows expected concentrations and equivalent limits of detection given the sampling protocol.

Category	Pollutant	Expected Concentration (ng/g)	Expected Loading (ng/m^2)	Expected Limit of Detection* (ng/g)
Metals	Arsenic	500-25,000		350.
	Cadmium	100-5,000		12.5
	Chromium	5,000-250,000		62.5
	Lead	10,000-500,000		75.
Pesticides	Chlordane-α	400	530	12.14
	Chlordane-γ	460	550	14.30
	Chlorpyrifos	540	820	25.62
	4,4'-DDD			73.73
	4,4'-DDE	170	620	13.62
	4,4'-DDT	250	530	18.36
	Dieldrin	250	560	55.23
	Heptachlor	280	300	43.23
	Malathion	220	420	21
PAHs	Anthracene			100.
	Benzo(a)pyrene	1120	1540	130.
	Chrysene	1260	1780	100.
	Phenanthrene			100.

*Expected Limit of Detection Given Sampling Protocol

8 References

Ashengrau, Ann, Robert Bornschein, Merrill Brophy, et al. *Three City Urban Soil-Lead Demonstration Project: Protocols for Sampling and Analysis of Soils, Dust, and Handwipes*. Internal EPA document, October, 1991.

American Society for Testing and Materials (ASTM). *Standard Practice for Collection of Dust from Carpeted Floors for Chemical Analysis.* Designation D 5438 - 94. ASTM, Philadelphia, PA. 1994.

Budd, W.T., J.W. Roberts, and M.G. Ruby. "Field evaluation of a high volume surface sampler for pesticides in floor dust." USEPA/RTI document EPA/600/3-90/030, March 1990.

CS3, Inc. High Volume Small Surface Sampler (HVS3) Operation Manual. CS3, Inc: Bend, OR. February 17, 1993.

Farfel, Mark R., P.S.J. Lees, D. Bannon, B.S. Lim, C.A. Rohde. "Comparison of Two Cyclone-Based Collection Devices for the Evaluation of Lead-Containing Residential Dusts." *Appl. Occup. Environ. Hyg.* 9(3):212-217. March 1994.

Harvard University/Emory University/Johns Hopkins University Standard Operating Procedures:

- G03 Identification Numbers for Samples and Forms
- G04 Chain-of-Custody and Sample Tracking
- G05 Storage and Shipping of Samples
- G06 Problem Management
- L02 Cleaning of Glass and Plastic Containers
- L05 Sieving and Division of Dust and Soil Samples
- L06 Extraction of Metals from Sampling Media
- L07 Analysis of Metals by GF-AAS
- L08 Analysis of Metals by ICP-MS
- L11 Extraction of Neutral Pesticides and PAHs from House Dust and Soil
- L14 Determination of Pesticides, Acid Herbicides, and PAHs by GC/MS

SwRI SOP 01-19-01 Log-In, Preparation and Shipment of Housedust Samples

USEPA. *EPA Method 200.8: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma - Mass Spectrometry*. April, 1991.

HVS3 Maintenance Record HVS3 number _____

Record all maintenance including calibration and filter bag changes.

Date: Name: Signature:	Maintenance:
Date: Name: Signature:	Maintenance:
Date: Name: Signature:	Maintenance:
Date: Name: Signature:	Maintenance:
Date: Name: Signature:	Maintenance:
Date: Name: Signature:	Maintenance:

House Plan Form
NHEXAS Phase I Study

Sample ID Label
21 -- dust field sample