National Human Exposure Assessment Survey (NHEXAS)

Arizona Study

Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona
Tucson, Arizona 85721

Cooperative Agreement CR 821560

Standard Operating Procedure **SOP-UA-F-13.1**

Title: Collection of Fixed Site Indoor and Outdoor Formaldehyde Passive Samples

Source: The University of Arizona

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

Notice: *The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), partially funded and collaborated in the research described here. This protocol is part of the Quality Systems Implementation Plan (QSIP) that was reviewed by the EPA and approved for use in this demonstration/scoping study. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA for use.*

Collection of Fixed Site Indoor and Outdoor Formaldehyde Passive Samples

1.0 Purpose and Applicability

1.1 This standard operating procedure (SOP) describes the methods used to sample residential indoor and outdoor atmospheres for the presence of formaldehyde using the PF-1 passive formaldehyde sampler. The PF-1 passive sampler is used as a fixed location monitor to determine time integrated exposure to the hazardous air pollutant Formaldehyde (HCOH). This procedure must be followed to insure consistent data retrieval of formaldehyde samples for the NHEXAS Arizona project of the University of Arizona/ Battelle/ Illinois Institute of Technology Consortium.

2.0 Definitions

2.1 BUCKET = A plastic container with a buckle top. One bucket is assigned to each household to be visited. Household identification and stage numbers are listed on the outside of the container. The bucket contains all paperwork to be completed by field staff or household respondents. It serves as the primary vehicle for securing and transporting forms, data and samples to and from the field.

2.2 CHAIN OF CUSTODY RECORD (Fig.2) = A vital data tracking and quality assurance form which accompanies every sample with an already generated Sample Identification Number (Sample ID) assigned to it by the Materials Technician.

2.3 DATA COORDINATOR = The employee of the research project who supervises data batching, entry and verification.

2.4 DIFFUSION = The movement of organic vapor from a region of higher concentration to a region of lower concentration, as defined by Fick's first law of diffusion.

2.5 DIFFUSIONAL (PASSIVE) SAMPLER = Impregnated disk assembly used to sample organic vapor molecules from the atmosphere using the principal of diffusion; no pump is used in the collection of the sample.

2.6 FIELD COORDINATOR = The employee of the research project who supervises field data collection and operations. The Field Coordinator collates HH specific data into HH packets, and upon completion of all visits, sampling and QA checks, forwards the packet to the Data Coordinator.

2.7 FIELD KIT = A sampling tool-box containing appropriate collection and storage utensils. For the passive collection

of airborne HCOH at fixed indoor and outdoor sites the kit should include: non-sterile and non-powdered latex gloves, Passive Sampling Stands, a psychrometer with three charged D cell batteries, and extra copies of the Passive VOC Sampling Data Sheet (Fig. 1).

2.8 FIELD STAFF = The Field Coordinator, the Team Leader and the Team Members.

2.9 HRP OFFICE = The Health Related Professions building, currently located at 1435 North Fremont Avenue, Tucson, AZ 85719. This is an annex of the Respiratory Sciences Center and the primary site of the operations for NHEXAS Arizona.

2.10 HOUSEHOLD(HH) = The residence occupied by study respondent(s).

2.11 HOUSEHOLD IDENTIFICATION NUMBER(HHID) = A unique number and character combination which is assigned to each respondent household for identification purposes. This number must be recorded on all data (forms, samples, questionnaires and correspondence) related to the household.

2.12 LAB SUPERVISOR = The employee of the research project who supervises laboratory analyses.

2.13 MATERIALS TECHNICIAN (Materials Tech) = The employee of the research project who is responsible for assembling and assigning field forms, questionnaires and equipment for field use. The Materials Tech assigns each sample a unique sample ID number upon receipt from Battelle.

2.14 N/A = Not Applicable.

2.15 NHEXAS Arizona = Acronym for National Human EXposure Assessment Survey, a research project conducted in Arizona by the University of Arizona/Battelle/Illinois Institute of Technology consortium.

2.16 PACKET = A sturdy, envelope-like container that can be fully closed and is large enough to hold the physical data forms generated from sampling and surveying a study household.

2.17 QUALITY ASSURANCE (QA)= All those planned and systematic actions necessary for ensuring the accuracy, validity, integrity, preservation and utility of collected data.

2.18 QUALITY CONTROL (QC) = Those quality assurance actions providing a means to control and measure the characteristics of a datum, processor the adherence to established parameters.

2.19 RESPONDENT = A person in the study population of NHEXAS Arizona. Each household is assigned a HHID number. All of the respondents are assigned an Individual Respondent Number (IRN). Each respondent can be uniquely identified by a HHID, and IRN combination.

2.20 SAMPLE = The formaldehyde absorbed by the monitor during sampling and the monitor unit itself.

2.21 SAMPLE IDENTIFICATION NUMBER = A numeric code that uniquely identifies every sample. It is generated by the NHEXAS tracking system by the Materials Technician at the HRP Office when the material is logged-in to the Tracking System.

2.22 SAMPLING STAND = A five foot tall three quarter inch (diameter) tubular steel upright rod with an unfinished hardwood base designed to hold the samplers at a fixed height during the sampling period. A 24 inch long crossbar (3/4 inch diameter) is fit to the top of the upright. The samples are suspended from eyehooks at the distal ends of the crossbar at least 18 inches apart.

2.23 SAMPLING UPTAKE RATE = The mass of a diffusing chemical divided by the product of its concentration and the sampling period (in units of µg/ppmv-h)

2.24 TEAM LEADER = The member of the field team who is primarilyresponsible for respondent contact, data collection, field form and questionnaire completion, and site QC checks of all data.

2.25 TEAM MEMBER= Member of a field team responsible for assisting the team leader in the collection of data and quality control checks in the field.

2.26 TRACKING SYSTEM = A database system containing information about the custody, transfer and storage of hard copy data, electronic data, field samples, and field sample aliquot.

2.27 VISIT = A scheduled appointment with participating respondents at their place of residence (HH) for the collection of samples, questionnaires and other data.

3.0 References

3.1 Instructions for the Use of Formaldehyde Monitor PF-1, Air Quality Research . Research Triangle Park, NC.

3.2 Gersling, K.L. and Rappaport, S.M. 1982. A passive Sampling

Device for Determining Formaldehyde in Indoor Air. **Environ. Intl.**8, 153-158.

3.3 Otson, R., Fellin, P.,Tran, Q.,and Stoyanoff, R. 1993. Examination of Sampling Methods for Assessment of Personal Exposures to Airborne Aldehydes. **Analyst**, 118, 1253-1259.

3.4 Standard Test Method for Measurement of Formaldehyde in Indoor Air (Passive Sampler Methodology) . Standard D 5014, ASTM. **Annual Book of ASTM Standards, 1989.**

3.5 Practice for Planning the Sampling of the Ambient Atmosphere. Standard D 1357, ASTM. American Society for Testing and Materials, Philadelphia, **Annual Book of ASTM Standards**, 1989.

4.0 Discussion

4.1 The PF-1 passive formaldehyde sampler (Air Quality Research Inc.) consists of a sodium bisulfite-impregnated disk in a glass tube. Sampling begins when the seal is removed from the glass tube and continues through the sampling period (5 - 7 days). Formaldehyde in the air diffuses into the tube at a known constant rate and is collected on the disk at the bottom of the tube. At the end of the sampling session, the tubes are capped and stored in a refrigerator at 4°C until analyzed.

4.2 Analysis is by the standard chromotropic acid method, in which absorbances are measured by a spectrophotometer by NIOSH method 3500. The procedure followed for the analysis of these samples is is given in SOP BCO-L-16.0.

4.3 In field tests, the PF-1 passive monitor has been shown to provide reliable measurements of formaldehyde in air at concentrations ranging from 0.025 to 1.0 ppmv. The amount of contaminant adsorbed is determined by the exposure time and contaminant concentration present in the sampled environment.

5.0 Responsibilities

5.1 The Project Co-Principal Investigator is responsible for:

5.1.1 Final review and approval of this procedure.

5.2 The Project Field Coordinator is responsible for:

5.2.1 Training the Field Staff how to properly use the PF-1 monitor

5.2.2 Training the Field Staff how to properly record field

observations and data on the field data sheets (Fig. 1).

5.2.3 Training the Materials Technician how to properly receive, log-in, store, re-assign and ship PF-1 badges.

5.2.4 Providing the Staff with the Project's SOPs pertaining to this procedure and its methods.

5.2.5 Insuring SOP procedures are followed by all Field Staff.

5.2.6 Communicating with the Lab Supervisor and the Materials Technician to insure that field sampling occurs smoothly.

5.2.7 Performing a QA Field audit on one out of ten HH sampled to insure setup, operation, teardown and sample transportation are accomplished according to protocol.

5.2.8 QA check of all field records within 24 hours of receipt from the Team Leader.

5.3 The Field Staff are responsible for:

5.3.1 Knowing and following the procedures described in this SOP.

5.3.2 Insuring proper labeling techniques of equipment and samples.

5.3.3 Recording all sampling information at set-up and teardown in the appropriate locations on the field sampling data sheet.

5.4 The Team Leader is responsible for:

5.4.1 Knowing the procedures described in this SOP and insuring that they are followed by the Team Members.

5.4.2 Arranging sampling dates and times with the HH.

5.4.3 Obtaining the PF-1 badges and sampling stands from the Materials Technician.

5.4.4 Directing Team Member(s) in the selection of appropriate sampling sites at each HH.

5.4.5 Ensuring the integrity and custody of the samples and field forms collected.

5.4.6 Quality control checks in the field.

5.4.7 Properly transporting the PF-1 monitors to and from the field on blue ice.

5.4.8 Forwarding individual QC checked field forms to the Field Coordinator for QA check within 24 hours of collection.

5.5 The Materials Technician is responsible for:

5.5.1 The proper documentation and assignment of samples to each HH.

5.5.2 Stocking the HH Bucket with appropriate field sampling forms.

5.5.3 Including Field Blanks with sample assignment as appropriate.

5.5.4 Shipping exposed samples and unexposed blanks to Battelle for analysis within one week of sample collection.

5.6 The Laboratory Director at Battelle or his designee shall be responsible for shipping fresh, unexposed diffusional samplers to the University of Arizona.

6.0 Materials and Equipment

6.1 PF-1 Kits (Air Quality Research, Research Triangle Park, NC 27709) containing two samplers with attached ribbons and two mounting pins. The PF-1 monitors have a six month shelf life prior to exposure when stored in cool dry conditions for extended periods of time, in an atmosphere free of organic vapors.

6.2 Metal fixed site sampling stands.

6.3 Field Kit

6.4 Cooler and Blue ice

7.0 Procedure

7.1 Preparation

7.1.1 Field Site Selection Criteria

The air velocity at the sampler face is an important parameter in diffusional sampling. Consequently, placement of the sampler should be such that stagnant layers are avoided to prevent nonrepresentative sampling. The minimum face velocity requirement for the PF-1 monitors is 25 ft/min. (For comparison, the normal air velocity in a typical ventilated room is 60 ft/min).

INDOOR SITE SELECTION

a) Sampling sites are chosen by the Team Leader. Indoor sampling occurs in the same room that P.M. (UA-F-3.0), Active VOC (UA-F-11.0), and passive VOC sampling (UA-F-12.0) is conducted.

b) Situate the sampling equipment in a main living area of the home. The main room is the room where the HH members spend the majority of their time when indoors. Bedrooms and private areas are to be avoided.

c) Place the sampler as close as possible to the center of

the room, but minimize the inconvenience to the respondents. The sample should be placed approximately 4 - 6 feet above the floor on the passive voc sampling stand, approximately 18 inches from any corners or walls.

d) Avoid placement near windows, air conditioners, and other ventilation devices. Avoid stagnant zones or direct drafts.

e) The sampler must be placed at least 10 feet from the P.M. Sampler (UA-F-3.0) and as far as possible from obvious sources of contamination such as naked pilot lights or gas heaters.

f) Once a suitable site is chosen confer with the HH respondents and insure that the selected location is acceptable to the participants. Explain your location decision as necessary and find a mutually agreeable site.

g) The passive VOC sampler (UA-F-12.0) is suspended from the same sampling stand as the PF-1 monitor. Both are suspended from the distal ends of the 24 inch tubular steel crossbar at least 18 inches from each other.

OUTDOOR SITE SELECTION

a) The passive formaldehyde set-up should be placed outdoors on the North side of the HH, at least ten feet from the midpoint of the wall. Placement on the north side of the home is intended to protect the sampler from direct sunlight.

b) If the North side of the HH faces a street or places the sampler at risk for theft or vandalism, place the sampler in a more secure part of the HH property. Indicate the location on the field data sheet (Fig. 1)

c) Do not locate the sampler under trees, near pools of standing water, near animal cages or under tables, etc.

d) Do not locate the sampler near obvious sources of contamination such as roads, alleys, barbequeue pits, etc.

e) The Active VOC sampler may be co-located on the passive VOC sampling stand.

f) The passive VOC sampler (UA-F-12.0) is suspended from the same sampling stand as the PF-1 monitor. Both are suspended from the distal ends of the 24 inch tubular steel crossbar at least 18 inches from each other between 4 - 6 feet in height.

g) The outdoor sampling stand has two galvanized steel large diameter funnels which are inverted and fixed to the distal ends of the stand. The cover serves to reduce excessive face-velocity effects on the sampling rate and to protect the sampler from rain [P. Koutrakis et al., Anal. Chem., 65, 209-214 (1993)].

7.1.2 Reagents - N/A

7.1.3 Standards and Blanks

Ten percent of all samples collected will be for QA and QC purposes. Field Blanks, Lab Blanks and Spike Blanks will undergo the same preparation, transportation, site set-up, collection and post-field storage and handling as the accompanying active samplers.

7.2 Field Procedures

7.2.1 Standards and Blanks Deployed

(a) The Field Blank for passive formaldehyde sampling will undergo similar preparation, transportation, site setup, collection and post-field storage conditions as the accompanying active sampler, but the blank will not be exposed.
(b) The Field Blanks will otherwise be treated the same as a 'live' sample. They will be transported in a cooler to the HH under appropriate conditions.
(c) The blank sample will be labeled as a 'blank' in the appropriate section of the Sampling Data Sheet (Fig. 1) and remain with the active samplers until collection.
(d) Upon collection, the blank receives no special handling, and is transported for analysis with the exposed samples.
(e) Duplicate sampling will be accomplished by running a duplicate set-up 'side by side' with the actual sampler. These duplicate PF-1 badges will be suspended no greater than 6 inches from each other.

7.2.2 Samples

(a) The PF-1 monitor and closure cap are packaged and supplied by the manufacturer in a sealed plastic wrap. Select an PF-1 Monitor from the cooler and don a pair of polyethylene gloves.
(b) Before initiating monitoring, record the following information on the sample and on the field sheet:
    a) Sample identification number
    b) Sampling start date
    c) Temperature and relative humidity
    d) Field team members initials
(c) Remove the plastic cap from the tube and commence sampling
(d) Record start time on the label of monitor and on the field sampling sheet.
(e) Attach the monitor to the stand.
(f) Record the Wet Bulb, Dry Bulb and RH on the field sheet

(Fig 1.)

(g) Leave the sampler hanging undisturbed for no less than 120 hours (5 days) and no more than 168 hours (7 days).

(h) When the sampling period is over, replace the cap and tightly seal the monitor.

(i) Record the stop date and stop time on the back label of the monitor and on the field data sheet.

(k) Return the monitor to the original packing box.

(l) Place the sealed box in the cooler on blue-ice. The monitors must be kept in an area free of organic solvents.

(m) Return the samplers on blue-ice to the UA Field Staging area. Once logged in the Tracking System, store the samples with their chain of custody record in the refrigerator at 4°C.

(n) Samples will be shipped to Battelle for analysis by the Materials Tech. within seven days of collection.

7.3 Calculations

7.3.1 The analytical procedures described in SOP BCO-L-16.0 are used to determine the amount of formaldehyde present on each monitor.

7.3.2 Calculate the sampling time (in minutes) for formaldehyde from the label of the exposed monitor and the information on the field data sheet.

7.3.3 Calculate the amount F (in μg) of formaldehyde collected by the PF-1 monitor using the following equation:

$$F = ((A^{580} - a)/ b)$$

where A^{580} = absorbance of the sample at 580 nm(in absorbance units, AU); a = intercept of the standard curve (AU); and b = slope of the standard curve (AU/μg).

7.3.4 Calculate the concentration C (in ppmv) of formaldehyde in the air from the relationship:

$$C = ((F - B)\ Kt)$$

where B = measured blank value for the PF-1 sampler lot (typically ~ .4 μg/sampler); K = sampling rate of the PF-1 monitor = 0.310 μg/ppm-h; and t = exposure time (h).

7.3.5 To calculate the concentration in mg/m^3 at 25^oC and 760 mm Hg, use the value in parts per million (ppm) determined in Step 7.3.4 in the following equation:

$$C(mg/m^3) = C(ppmv) \times (30.03 / 24.45).$$

7.3.6 If the sampling temperature and pressure are significantly different from 25^oC and 1 atm, respectively, the concentration of formaldehyde is corrected as follows:

$$C_o(mg/m^3) = C\ (101.3\ T / 298\ P)$$

where T = temperature recorded at the sample site (in ^oK); P = pressure at the sample site in kPa.

7.4 Quality Control

Field teams consist of 2 - 3 Team members assigned to different tasks when in the HH. On the OVM and HCOH sampling sheet (Figure 1), there are double check points at many critical data entry/recording moments. These opportunities serve as an independent verification of the data and the readings recorded. The Team Member independently verifies the values recorded by their team-mate and records a "✓" in the appropriate box.

Once the Field Team Member has completed the set-up in either the indoor or outdoor environment, she or he switches with a second Field Team Member and verifies the readings recorded for the alternate location. Ten percent of all samples collected will be for QA and QC purposes.

7.4.1 The overall performance of the monitoring method is evaluated using spiked controls, blanks, and duplicates.

7.4.2 Given the small amounts of material that are collected with the PF-1 tubes, it is important that samplers used as spikes, blanks, duplicates, and field samplers come from the same lot number, since the background compounds present on unexposed samplers may vary significantly from lot to lot.

7.4.3 At least one sampler should be prepared for analysis as a field spike, one sampler each presented for analysis as a field blank and an unexposed blank, and one field duplicate sampler taken with every 30 field samples.

7.4.4 Sampler Blanks

(a) The purpose of the field blank is to ensure that the adsorption by the samplers of any vapors extraneous to the atmosphere at the sampling site will be detected.

(b) To prepare the field blank, remove a monitor from the container at the monitoring site.

(c) Remove the cap from the tube, then immediately replace it on the tube.

(d) On the monitor label record the word "Field Blank" as well as the time, date and sample id with the HHID. Record the same information on the Field Data Sheet.

(c) Submit the field blank, along with the exposed monitors, to the laboratory for analysis.

(d) The unexposed blank should be left in the original sealed state. Results from the unexposed blanks are used to ascertain the contribution of the monitors to the analytical results.

(e) Results from the unexposed blanks are used to correct sample results if their values are sufficiently constant to warrant their subtraction from the field values as a conventional blank.

7.4.5 Spiked Controls

(a) Spiked controls are used to verify recoveries of the formaldehyde, since techniques and the presence of multiple contaminants can affect recovery efficiencies.

(b) To prepare a spiked control, first calculate the amount W of material to be injected from the equation:

$$W = KCt$$

(c) For formaldehyde, assuming a concentration of 0.1 ppmv and a total sampling time of 168 hours (7 days), it follows that:

COMPOUND	K (μg/ppmv-h)	C (ppmv)	t (h)	W (μg)
Formaldehyde	0.310	0.1	168	5.21

(d) Remove a monitor from the container in the lab at Battelle.

(e) Remove the cap and place a filter paper of the same diameter as the inner diameter of the PF-1 tube on the impregnated disk in the tube.

(f) Using the formaldehyde standard solution (40 µg/mL) prepared in SOP BCO-L-16.0 inject the calculated quantity of HCOH on to the filter paper.

(g) Replace the cap and allow the monitor to sit for 16 - 24 hours to allow total transfer of the formaldehyde from the filter paper to the disk.

(h) Remove the filter paper from the monitor.

(i) Proceed with the determination of the amount of formaldehyde recovered as described in SOP BCO-L-16.0.

7.4.6 Field Tolerance Limits

(a) Violations of site selection and sampling criteria must be recorded on the field data sheet.

(b) Every effort must be made to insure that the passive formaldehyde and OVM Samplers are at least 18 inches from each other and any wall or airflow distorting surface.

7.4.7 Corrective Actions

(b) Apparent mislabeling problems detected in the field may be corrected by the Team Members when appropriate and in accordance with SOP #UA-C-2.0.

8.0 Records

8.1 PF-1 and HCOH Sampling Data Sheet (Figure 1)

8.1.1 This sampling data sheet serves as a record of critical field operation and tracking information for passive VOC sampling. The data sheet (Fig. 1) serves as the primary record on in-field observations and activities.

8.2 Chain of Custody Record (Figure 2)

8.2.1 This record (Fig. 2) will serve as the primary record of sample custody. The Team Leader and the Field Team are responsible for the thorough completion of this form. The completed original Chain of Custody Record will remain with the data sample except when they are left at a HH while sampling is taking place. The Chain of Custody Record will be stored with the appropriate field sampling sheet in the HH Bucket until the PF-1 tube is re-collected from the field. The custody

record will then be reunited with the sample by the Team Leader.

8.3 Relative timing of passive formaldehyde sampling (Figure 3).

8.3.1 This diagram documents the relative timing of passive VOC sampling to other sample collection activities for NHEXAs Az.

8.4 Passive VOC Sampling -Trouble shooting Guide (Figure 4)

Figure 1. OVM and HCOH Sampling Data Sheet

OVM & HCOH Sampling Data Sheet

Project ID NHEXAS Az. Stage #_____.

HHID_____/____

Team Leader_____. Sampling Date _____/_____/_____.
mo. day year

Indoor Site Selection Criteria met? [Y] or [N]. If No, How and why _____

INDOOR			
SETUP		TAKEDOWN	
Date __/__/__		Date __/__/__	
Time :		Time :	
OVM ID #		OVM ID #	
E -series ID #		E -series ID #	
HCOH ID#		HCOH ID#	
WB____ DB____ RH____		WB____ DB____ RH____	
BY_____	√ BY_____	BY_____	√ BY_____

PSYCHROMETER ID#_____ PSYCHROMETER ID#_____

Outdoor Site Selection Criteria met? [Y] or [N]. If No, How and why _____

OUTDOOR			
SETUP		TAKEDOWN	
Date __/__/__		Date __/__/__	
Time :		Time :	
OVM ID #		OVM ID #	
E -series ID #		E -series ID #	
HCOH ID#		HCOH ID#	
WB____ DB____ RH____		WB____ DB____ RH____	
BY_____	√ BY_____	BY_____	√ BY_____

PSYCHROMETER ID#_____ PSYCHROMETER ID#_____

COMMENTS:

FORM ID = UA - F12.0 - 1.0

Figure 2. Chain of Custody Record

Chain of Custody Record
NHEXAS Arizona Project (CR-821560)
Respiratory Sciences
1435 N. Fremont Ave
Tucson, AZ 85719
(520) 626 - 4226

Sample Type: ______________________. page ___ of ___.

Generated by: ______________________/______________________
print name *signature*

Date Generated	Time	Sample ID	# of Containers	Remarks
___/___/___	___:___			

History of Sample Handling and Custody

Relinquished or Received	Signature	Date mo / day / yr	Time	Action
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
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[Rel] or [Rec]		___/___/___	___:___	
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[Rel] or [Rec]		___/___/___	___:___	

FORM = UA-G4.0 - 1.2

Attach Additional Pages as Necessary

Figure 3. Relative Timing of Passive HCOH Sampling (page 1 of 2)

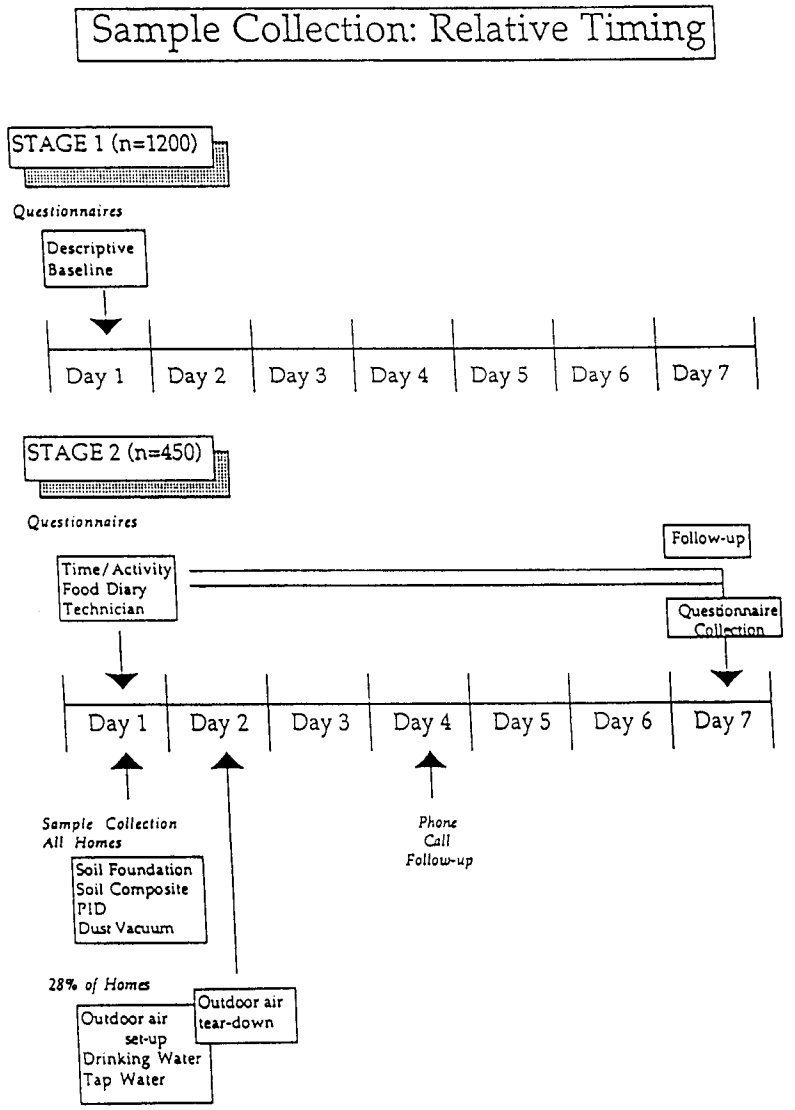

Figure 3. Relative Timing of Passive HCOH Sampling (page 2 of 2)

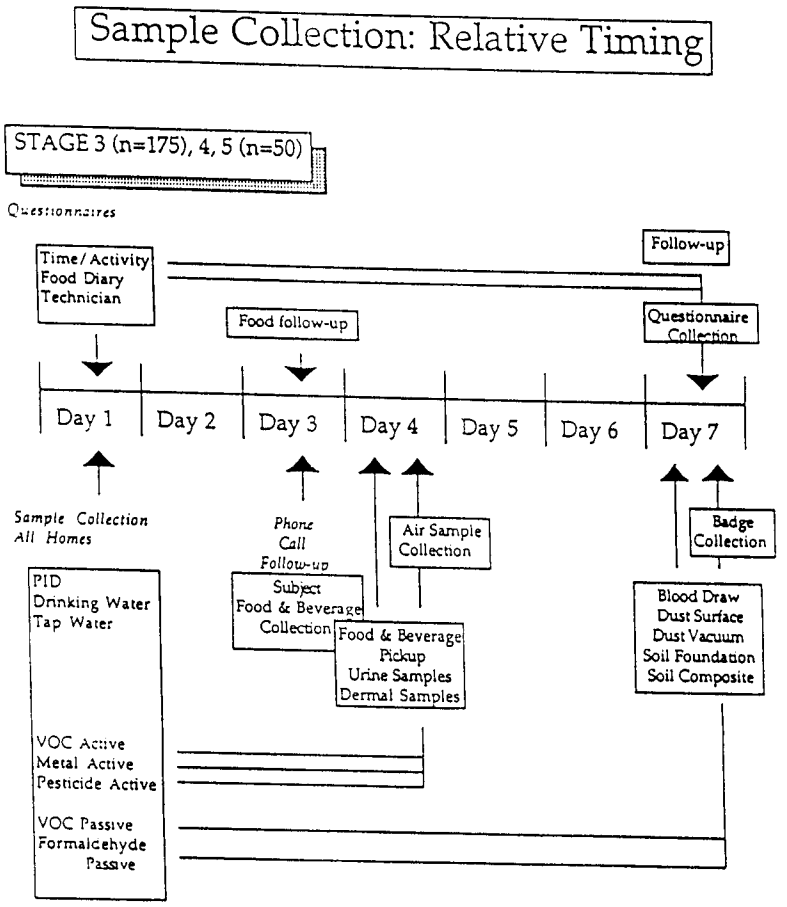

Figure 4. Field Notes and Troubleshooting Guide for Passive HCOH Sampling

No field notes or Troubleshooting guides are currently on record for UA-F-13.0. Additions will be appended and the SOP will be reviewed and updated in accordance with UA-G-1.0 as appropriate.

Schematic of Rain Shelter included below:

Figure 5. Sample Flow and Handling of passive formaldehyde and VOC samples