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-12.0**

Title: Use of a Passive Sampling Device for the Collection of Airborne VOCs at Fixed Indoor and Outdoor Sites

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.*

Use of a Passive Sampling Device for the Collection of Airborne VOCs at Fixed Indoor and Outdoor Sites

1.0 Purpose and Applicability

This standard operating procedure (SOP) describes the methods used to sample residential indoor and outdoor atmospheres for the presence of certain volatile organic compounds (VOCs) by means of absorption onto activated charcoal contained within a sampling badge. Activated charcoal diffusional samplers are applicable to a large number of VOCs. For the present purposes, they are used as fixed location monitors to determine time-integrated exposure to benzene, toluene, and trichloroethylene. This procedure is used in support of the NHEXAS Arizona Project, AZ Border Project (Border AZ) and other Health and Environment projects.

2.0 Definitions

2.1 AZ Border = The US border region is defined as 100 km north of the border. In this study, we define the border as 40 km north of the border. The Arizona Border Study or "Border AZ" is an alias for "Total Human Exposure in Arizona: A Comparison of the Border Communities and the State" conducted in Arizona by the University of Arizona / Battelle / Illinois Institute of Technology Consortium.

2.2 BUCKET = A plastic container with a buckle top or tight-fitting lid. One bucket is assigned to each household to be sampled. Household identification and stage numbers are listed on the outside of the container. The bucket contains all paperwork and questionnaires 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 through the course of the study.

2.3 CHAIN OF CUSTODY RECORD (Fig.2) = A vital data tracking and quality assurance form which accompanies every sample.

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

2.5 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.

2.6 DIFFUSIONAL (PASSIVE) SAMPLER = Badge 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.

2.7 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.

2.8 FIELD KIT = A sampling tool-box containing appropriate collection and storage utensils. For the passive collection of airborne VOCs 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. 2).

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

2.10 HRP OFFICE = The **H**ealth **R**elated **P**rofessions building, currently located at 1435 North Fremont Avenue, Tucson, AZ 85719. This is an annex of the Arizona Prevention Center and the primary site of the operations for NHEXAS Arizona project, AZ border project (BORDER AZ) or other Health and Environment projects.

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

2.12 **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.

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

2.14 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.

2.15 N/A = Not Applicable.

2.16 NHEXAS Arizona = Acronym for **N**ational **H**uman **EX**posure **A**ssessment **S**urvey, a research project conducted in Arizona by the University of Arizona/Battelle/Illinois Institute of Technology consortium.

2.17 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.

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

2.19 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.

2.20 RESPONDENT = A person in the study population of NHEXAS Arizona project, AZ Border project, and other Health and Environment projects. 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.

2.21 SAMPLE = The VOCs absorbed by the monitor during sampling and the monitor itself.

2.22 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.

2.23 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 eye-hooks at the distal ends of the crossbar at least 18 inches apart (see Fig. 6.).

2.24 SAMPLING UPTAKE RATE = The mass of a diffusing chemical divided by the product of its concentration and the sampling period (in units of cm^3/min.).

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

2.26 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.

2.27 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.

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

2.29 VOCs = Volatile Organic Compounds

3.0 References

3.1 3M Organic Vapor Monitors #3500/3510 Instructions for Use, Occupational Health and Safety Products Division/3M, 1993.

3.2 3M Organic Vapor Monitor Sampling and Analysis Guide for Organic Vapor Monitors 3500/3510 and Organic Vapor Monitors 3520/3530, 1993.

3.3 H.C. Shields and C.J. Weschler, "Analysis of Ambient Concentrations of Organic Vapors with a Passive Sampler," **JAPCA**, 37, 1039-1045 (1987).

3.4 R. Otson, P. Fellin, and S.E. Barnett, "Field Testing of a Passive Monitor for Airborne VOCs," paper 92-80.07, 85th A&WMA Annual Meeting, June 1992.

3.5 "Sampling Workplace Atmospheres to Collect Organic Gases or Vapors with Activated Charcoal Diffusional Samplers," Standard D 4597, American Society for Testing and Materials, Philadelphia, **Annual Book of ASTM Standards**, 1992.

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

4.0 Discussion

4.1 Diffusional sampling is governed by Fick's first law of diffusion (see Ref. 3.5). This states that for a constant concentration gradient, the mass of material transferred to the sampling layer is given by: $W = DA/L(C-C_o)t$ where W= mass of material (mg); D= diffusion coefficient (cm^2); L= length of diffusion path (cm); C= gas-phase concentration at sampler face (mg/cm^3); C_o=gas-phase concentration at adsorbing layer surface (mg/cm^3); and t=exposure time (min.).

4.2 The sampling rate (K_o) of a diffusional sampler for a specific compound may be expressed as: $K_o=DA/L=W/(C-C_o)t$.

4.3 The sampler consists of a diffusion screen and a charcoal sorbent pad assembled in a disk-shaped plastic holder. The diffusion screen creates a concentration gradient from its surface to the carbon sorbent pad. Sampling begins by removing the monitor from the aluminum packing container and continues throughout the sampling period (5-7 days). VOCs in the air diffuse into the monitor and are adsorbed at constant sampling rates. At the end of the sampling period, the monitor is capped and stored in a refrigerator until analyzed. The amount of contaminant adsorbed is determined by the exposure time and contaminant concentration present in the sampled environment.

4.4 The procedure followed for the analysis of these samples is given is SOP BCO-L-17.X.

4.5 In field testing, the 3M OVM 3500 passive monitor has been shown to provide reliable measurements of selected airborne VOCs at concentrations ranging from about 2 to 6000 micrograms/m^3.

5.0 Responsibilities

5.1 The Project CO-Principal Investigator is responsible for:

Final review and approval of this procedure.

5.2 The Project Field Coordinator is responsible for:

(a) Training the Field Staff how to properly use the OVM monitor
(b) Training the Field Staff how to properly record field observations and data on the field data sheets (Fig. 1).
(c) Training the Materials Technician how to properly receive, log-in, store, re-assign and ship OVM badges.
(d) Providing the Staff with the Project's SOPs pertaining to this procedure and its methods.
(e) Insuring SOP procedures are followed by all Field Staff.
(f) Communicating with the Lab Supervisor and the Materials Technician to insure that field sampling occurs smoothly.
(g) 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.
(h) QA check of all field records within 24 hours of receipt from the Team Leader.

5.3 The Field Staff are responsible for:

(a) Knowing and following the procedures described in this SOP.
(b) Insuring proper labeling techniques of equipment and samples.
(c) 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:

(a) Knowing the procedures described in this SOP and insuring that they are followed by the Team Members.
(b) Arranging sampling dates and times with the HH.
(c) Obtaining the OVM badges and sampling stands from the Materials Technician.
(d) Directing Team Member(s) in the selection of appropriate sampling sites at each

HH.

(e) Ensuring the integrity and custody of the samples and field forms collected.
(f) Quality control checks in the field.
(g) Properly transporting the OVM monitors to and from the field on blue ice.
(h) 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:

(a) The proper documentation and assignment of samples to each HH.
(b) Stocking the HH Bucket with appropriate field sampling forms.
(c) Including Field Blanks with sample assignment as appropriate.
(d) 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 3M OVM 3500 Organic Vapor Monitors (Occupational Health and Safety Products Division, 3M), ten-unit lots. The 3500 monitors have an 18-month shelf life when stored in cool, dry conditions which do not exceed 90°F (32.2°C) for extended periods of time, in an atmosphere free of organic vapors including ethylene oxide or formaldehyde.

6.2 Metal fixed site stands.

6.3 Field Kit

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 non-representative sampling. The minimum face velocity requirement for the OVM 3500 monitors is 25 ft/min. (For comparison, the normal air velocity in a typical ventilated room is 60 ft/min.).

A. INDOOR SITE SELECTION

(a) Sampling sites are chosen by the Team Leader. Indoor sampling occurs in the same room that PM (UA-F-3.X), Active VOC (UA-F-11.X), and passive formaldehyde sampling (UA-F-13.X) 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 and as far as possible from obvious sources of contamination such as naked pilot lights or gas heaters.

(e) The sampler should be placed at least 10 feet from the PM Sampler (UA-F-3.X) and other indoor samplers whenever possible. However, space to set-up equipment and access to power outlets will be limited and compromises will need to be made. Record the sampler location on the fieldsheet.

(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.

(h) The passive formaldehyde sampler (UA-F-13.X) is suspended from the same sampling stand as the OVM monitor. Both are suspended from the distal ends of the 24 inch tubular steel crossbar at least 18 inches from each other (Fig. 6.).

B. OUTDOOR SITE SELECTION

(a) The passive VOC set-up should be placed outdoors on the North side of the HH, at least ten feet from the midpoint of the wall and four to six feet above the ground. 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, barbecue pits, etc.

(e) The Active VOC sampler may be co-located on the passive VOC sampling stand. The sampler should be placed at least 10 feet from the PM Sampler (UA-F-3.X) and other outdoor samplers whenever possible. However, space to set-up equipment and access to power outlets will be limited and compromises will need

to be made. Record the sampler location on the fieldsheet.

(f) The passive formaldehyde sampler (UA-F-13.X) is suspended from the same sampling stand as the OVM 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

TROUBLESHOOTING

Do not handle the OVM badge without wearing disposable latex gloves. Record the manufacturers lot number on the field sheet (Fig 1.) next to the sample id once the sample has been removed from the storage can for field placement.

7.2.1 Standards and Blanks Deployed

(a) The Field Blank for passive VOC 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 connected 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 OVM badges will be suspended no greater than 6 inches from each other.

7.2.2 Samples

A. SETUP

(a) The OVM 3500 monitor and closure cap are packaged and supplied by the manufacturer in a sealed aluminum can. Select an OVM Monitor from the cooler and don a pair of non-sterile, non powdered latex gloves.

(b) Before initiating monitoring, record the following information on the plastic can lid and / or on the field sheet:

1. Sample-ID
2. manufacturers serial / ID # (Field Sheet Only)
3. Sampling start date and time
4. Temperature and relative humidity (Field Sheet Only)
5. Field team members initials

(c) Remove the plastic can lid by pulling up on the ring tab.

(d) Remove the monitor from the can. Store the closure cap and can for use when the sampling period is ended.

(e) Quickly record the date, start time and the Sample-ID on the label on the back of the monitor and on the field sampling sheet.

(f) Attach the monitor to the stand. DO NOT REMOVE THE WHITE FILM AND PLASTIC RING. Record the temperature and relative humidity 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) Verify that the sampler is securely affixed to the eye-hook in the sample stand. Use **Teflon tape** to secure the sampler clasp to the eye hook as needed.

B. TAKEDOWN

(a) Verify that the sampler is still suspended from the eye-hook when you return to collect the monitor.

(b) Don a pair of non-sterile, non powdered latex gloves.

(c) Remove the sampler from the eye-hook.

(d) Remove the plastic ring and white film

(e) IMMEDIATELY SNAP THE CLOSURE CAP FIRMLY TO THE MONITOR BODY. SEAL THE TWO PORT PLUGS TIGHTLY.

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

(g) Return the monitor to the can and seal the can with the plastic lid provided.

(h) Place the sealed can in the cooler on blue-ice.

(i) 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.

7.3 Calculations

7.3.1 Using the analytical procedures described in SOP BCO-L-17.X, determine the amount of each target compound present on the monitor (in milligrams).

7.3.2 Calculate the sampling time (in minutes) for the target compounds from the back label of the exposed monitor, and of the sampling data sheet / field sheet.

7.3.3 Calculate the concentration C (in mg/m^3) of the target compound using the following equation:

$$C\ (mg/m^3) = W/K_o(DE)t.$$

Where W = background-corrected mass of target compound desorbed (mg);
K_o = monitor sampling rate (cm^3/min.); DE = recovery (desorption) coefficient;
t = sampling time (min.).

7.3.4 The sampling rates, recovery efficiencies, and capacity limits for the target compounds are (See Ref. 3.2):

Compound	Sampling Rate (cm^3/min.)	Recovery Coefficient	Capacity (mg)
Benzene	35.5+/-0.6	0.95	22
Toluene	31.4+/-0.6	1.00	>25
Trichloroethylene	31.1+/-0.2	0.99	>25

7.3.5 To calculate the concentration in parts per million (ppm) at 25°C and 760 mm Hg, use the value in mg/m^3 determined in Step 7.3.3 in the following equation:
$C(ppmv)=C(mg/m^3)$ X 24.45/MW.
Where MW = molecular weight of target compound (in g/mole).

7.3.6 If the sampling temperature is significantly different from 25°C, then the temperature-corrected concentration C_o is obtained from: C_o = $C(mg/m^3)$ X (the square root of $298^oK/T_s$) or C_o = C(ppmv) X (the square root of $298^oK/T_s$). Where T_s = temperature recorded at the sample site (in °K). This correction eliminates an error of about 1% for every 10°F (5.6°C) increment above or below 77°F (25°C) (see Ref. 3.2).

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. 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 OVM 3500 badges, it is important that samplers used as spikes, blanks, duplicates, and field sampling 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 aluminum can at the monitoring site.
(c) Immediately remove the white film and plastic ring and replace with the closure cap.
(d) On the back of the monitor record the word "Field Blank" on the line labeled "Start Time" along with the HHID. Record the information on the Field Data Sheet.
(e) Submit the field blank, along with the exposed monitors, to the laboratory for analysis.
(f) 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.
(g) 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 (Prepared at Battelle)

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

efficiencies.

(b) To prepare a spiked control, remove a monitor from the aluminum can in the laboratory at Battelle.

(c) Remove the white film and plastic ring from the monitor.

(d) Place a 2.5 cm diameter filter paper on the spacer plate.

(e) Snap the closure cap on the monitor

(f) Calculate the amount of material to be injected from the equation:

$$V = (W \times 10^{-3})/p = K_o \times C \times t \times (10^{-6}\ m^3/cm^3) \times 10^{-3}/p.$$

Where V = volume of liquid injected (cm^3); W = amount of liquid injected (mg); p = density of the liquid (g/cm^3); K_o = sampling rate of monitor (cm^3/min.); C = average concentration (mg/m^3); and t = sampling time (min.).

(g) For the target compounds, assuming a concentration of 0.005 ppmv and a total sampling time of 10,080 min. (7 days), it follows that:

Compound	K_o (cm^3/min.)	C (mg/m^3)	t (min.)	W (mg)	p (g/cm^3)	V micro-L
Benzene	35.5	0.003	10,080	0.0011	0.874	1.2
Toluene	31.4	0.004	10,080	0.0013	0.867	1.5
Trichloroethylene	31.1	0.005	10,080	0.0016	1.464	1.1

(a) Using the target compound standard solution prepared in SOP BCO-L-17.X, inject the calculated quantities of the target compounds onto the filter paper through the center port.

(b) Allow the monitor to sit for 16-24 hours to allow total transfer of the compounds from the filter paper to the sorbent.

(c) Remove the filter paper from the monitor.

(d) Proceed with the elution and determination of amounts recovered as described in SOP BCO-L-17.X.

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

Apparent mislabeling problems detected in the field may be corrected by the Team Members when appropriate and in accordance with SOP #UA-C-2.X.

8.0 Records

8.1 OVM 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)

8.2.2 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 OVM badge 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 VOC 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

Study: ○ 1. NHEXAS ○ 2. Border ○ 3. ____ ○ 4. ____ ○ 5. ____

Stage # ☐

Collapsed? Y ○ N ○ S ○

Team Leader: ____ Tech ID ☐☐ Init.

HHID ☐☐☐☐☐☐ F.S. ☐ Visit ☐

Sampling Date ☐☐ / ☐☐ / ☐☐ MO / DAY / YR

Set up QC: [ ]
Take down QC: [ ]

SET UP			TEAR-DOWN		
Indoors					
Date = ____/____/____ Time = ___:___			Date = ____/____/____ Time = ___:___		
Site Criteria = [Y] or [N] :			Site Criteria = [Y] or [N] :		
Psychrometer ID:			Psychrometer ID:		
DB =	WB =	RH=	DB =	WB =	RH=
			ID Match	Use Type	Comments
OVM ID :	LOT #		[Y] or [N]		
OVM ID :	LOT #		[Y] or [N]		
OVM ID :	LOT #		[Y] or [N]		
PF1 ID :	AQR #		[Y] or [N]		
PF1 ID :	AQR #		[Y] or [N]		
PF1 ID :	AQR #		[Y] or [N]		
Outdoors					
Site Criteria = [Y] or [N] :			Site Criteria = [Y] or [N] :		
Psychrometer ID:			Psychrometer ID:		
DB =	WB =	RH=	DB =	WB =	RH=
			ID Match	Use Type	Comments
OVM ID :	LOT #		[Y] or [N]		
OVM ID :	LOT #		[Y] or [N]		
OVM ID :	LOT #		[Y] or [N]		
PF1 ID :	AQR #		[Y] or [N]		
PF1 ID :	AQR #		[Y] or [N]		
PF1 ID :	AQR #		[Y] or [N]		
Tech ID:_____	QC √ By:_____		Tech ID:_____	QC √ By:_____	

FORM ID = UA-F-12.0-2.0

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]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	
[Rel] or [Rec]		___/___/___	___:___	

FORM = UA-G4.0 - 1.2

Attach Additional Pages as Necessary

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

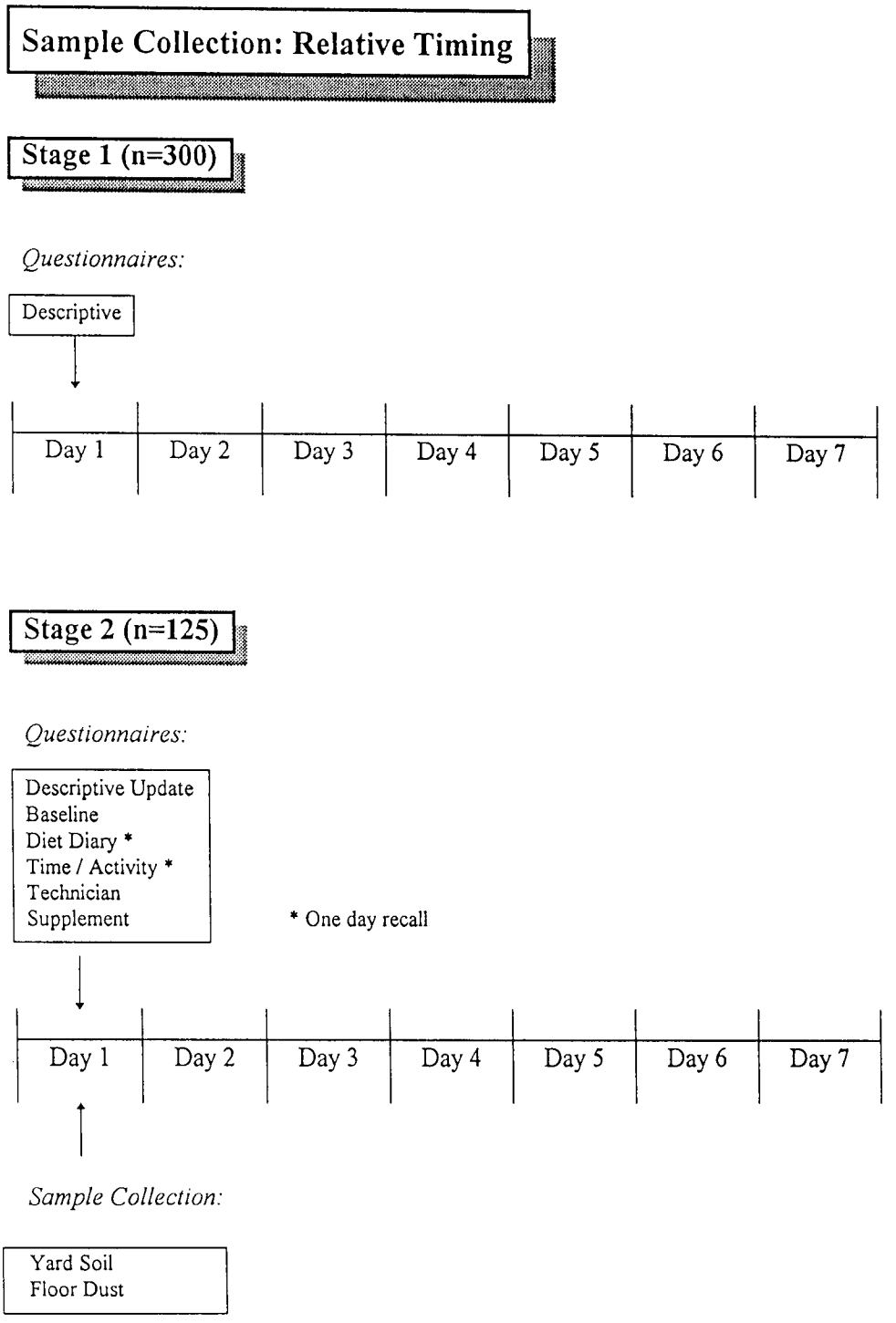
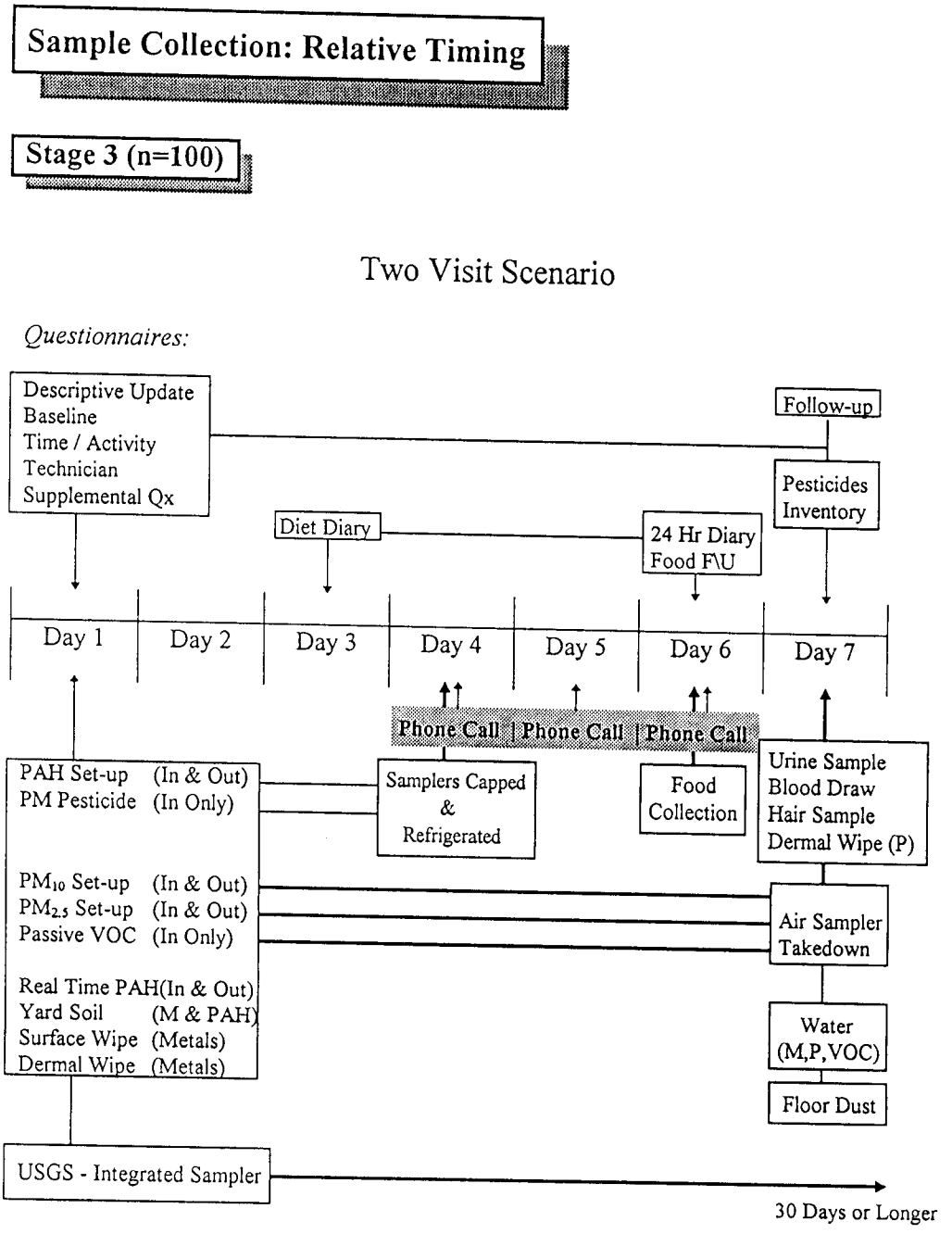
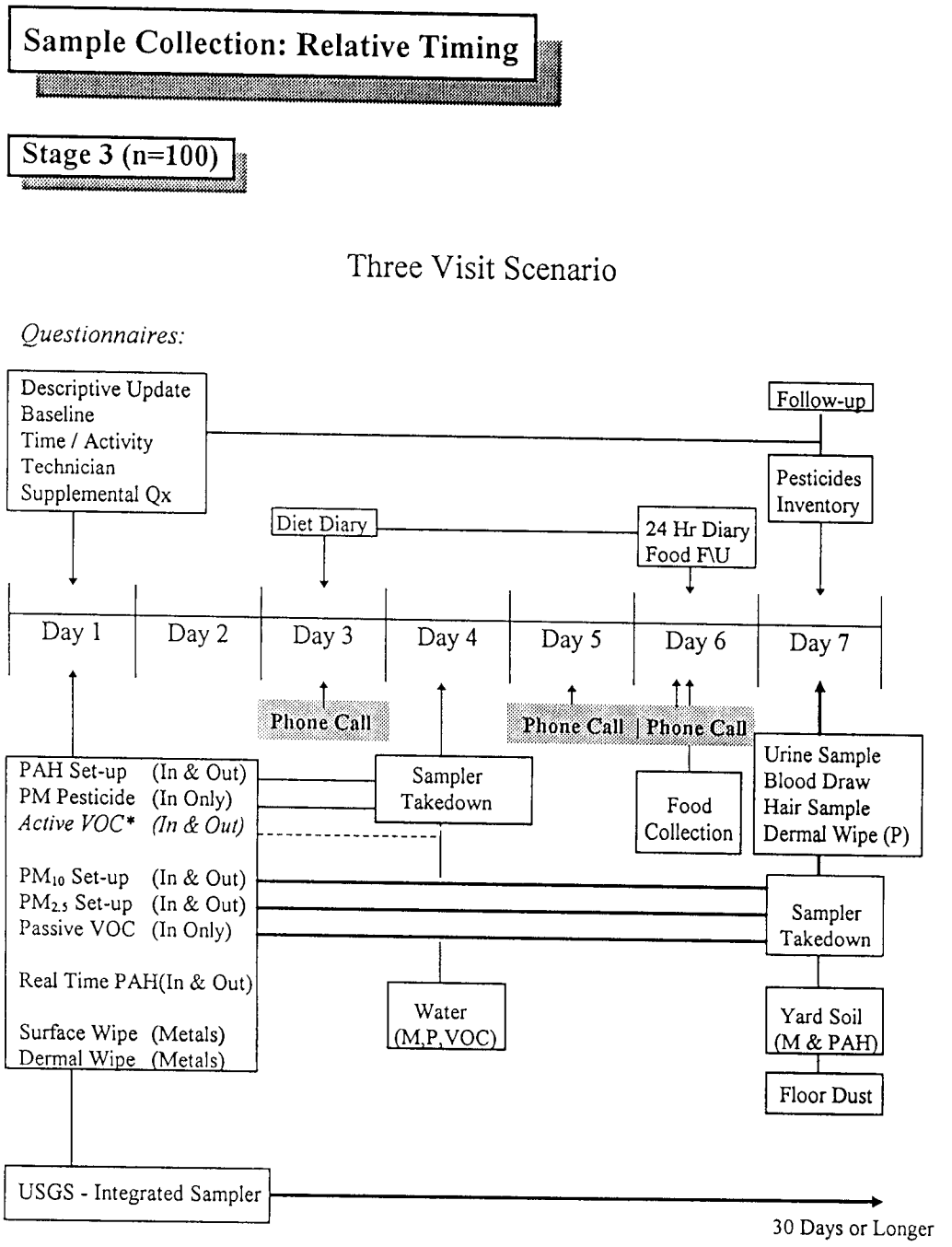


Figure 3. Relative Timing of Passive VOC Sampling (page 2 of 3)



* Active VOC is collected in a subset of 25 homes only

Figure 3. Relative Timing of Passive VOC Sampling (page 3 of 3)



* Active VOC is collected in a subset of 25 homes only

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

(1) If the OVM Badge has fallen to the ground during the sampling period - the sample is invalid and must be "killed" upon return to the Field Office. Record the fate of the sample on the field sheet and on the Chain of Custody Record.

(2) Similarly, if the stand has been knocked to the ground, or if it has blown-over, the sample is invalid and must be "killed" upon return to the Field Office. Record the fate of the sample on the field sheet and on the Chain of Custody Record.

(3) You must ask the primary respondent or other members of the household whether the sampling stand had fallen over during the sampling week.

Figure 5. Sample Flow and Handling of Passive VOC samples

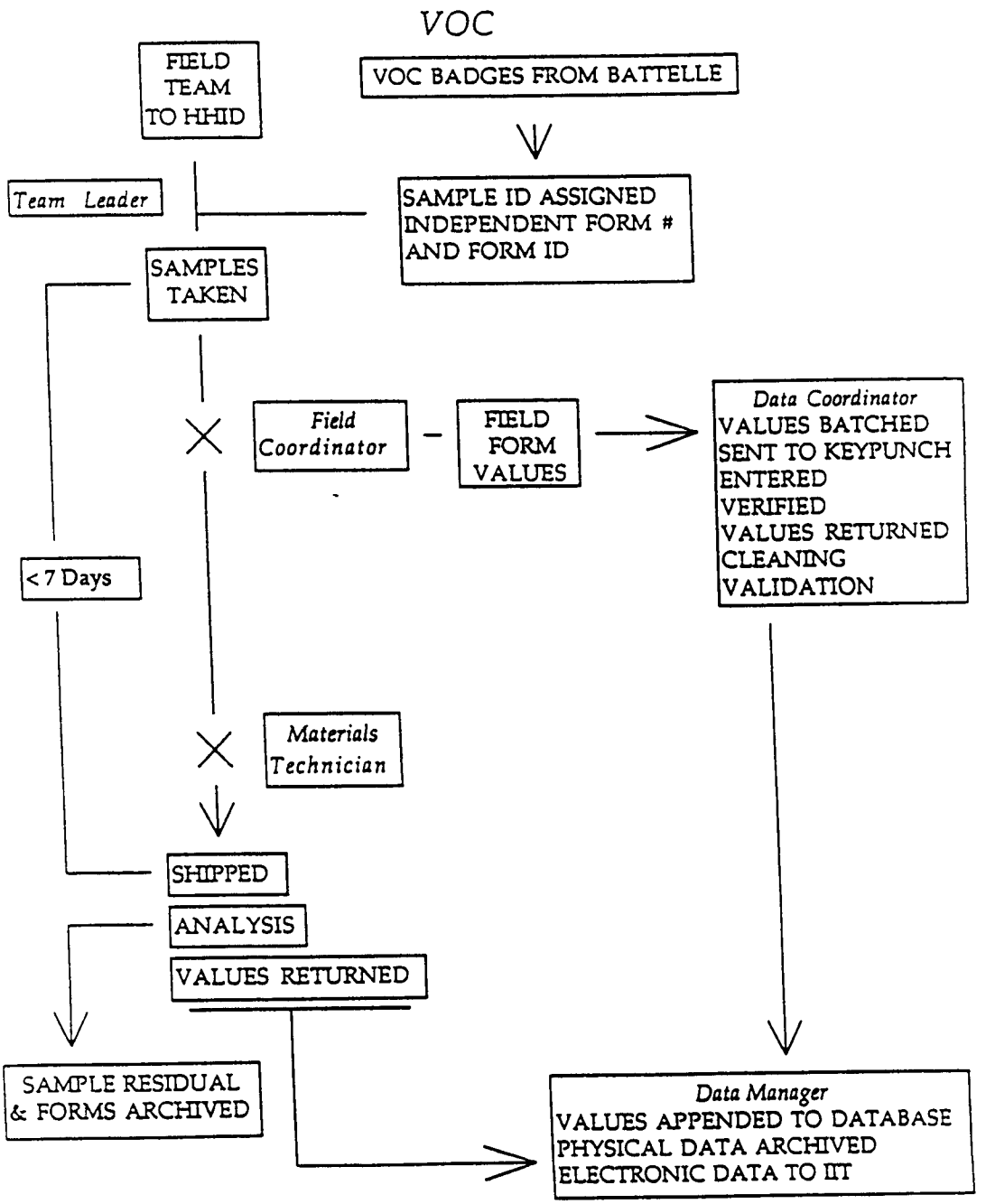


Figure 6. Passive VOC and HCOH Sampling Stand.