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-6.1**

Title: Field Collection of Residential Foundation Soil 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.*

Field Collection of Residential Foundation Soil Samples

1.0 PURPOSE AND APPLICABILITY

This SOP establishes a uniform procedure for the collection of residential foundation soil samples in the field. This procedure must be followed to insure consistent and reliable collection of outdoor soil 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 through the course of the study.

2.2 CHAIN OF CUSTODY RECORD = A vital data tracking and quality assurance form which is attached to every sample sheet or sample container (see Fig. 2) The Chain of Custody Record used to track soil samples is a modified version of UA-G4-1.0. This custody record is stamped on the paper bag in which the ziploc bag and sample are transferred to and from the field. Chain of custody commences with sample generation by Field Team members or the Materials Technician.

2.3 FIELD KIT = A sampling tool-box containing appropriate collection and storage utensils. For soil sampling the kit contains soil sample containers (Freezer Ziploc bags), tablespoons, a 30 yard tape measure, thin film sheet, indelible ink pens, two stainless steel trowels and additional copies of the Soil Sampling Data Sheet. The ziploc freezer bags in which the samples are collected are housed within a paper bag.

2.4 HOUSEHOLD(HH) = The residence occupied by study respondents.

2.5 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) generated by the household.

2.6 MATERIALS TECHNICIAN (Materials Tech) = The employee of the research project who assigns unique soil sample ID numbers

to sample collection containers before sample collection in the field.

2.7 N/A = Not Applicable.

2.8 PACKET = This is a large household specific folder or envelope which holds the physical questionnaires and field sampling forms collected from a study household.

2.9 SAMPLE = The composite foundation sample collected according to protocol at the foundation of participating households. Samples will be collected, transported and stored in appropriate soil sample containers.

2.10 SAMPLE ID = A numeric code, generated by NHEXAS tracking system, that uniquely identifies every sample.

2.11 SOIL SAMPLE CONTAINER = Soil samples will be collected, transported and stored in resealable polyethylene gallon currently using Ziploc Freezer bags to collect soil for metals and pesticide analysis.

2.12 SOIL SAMPLING DATA SHEET = A field data sheet to record specific information regarding yard soil collection, transport, storage and custody (see Fig.1).

2.13 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.

2.14 TEAM MEMBER = The member of a field team responsible for assisting the Team Leader in the collection of data and completion of quality control checks in the field.

2.13 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 Lebowitz, M.D. 1993. Study Design (Revision of 31 Dec. 1993). EPA NHEXAS Cooperative Agreement.

4.0 DISCUSSION

4.1 This SOP outlines the correct procedure for the collection of soil samples at participating households according to the strategies outlined in the NHEXAS study. Soil samples will

be obtained from the residential foundation (two trowels full from each of four sides). The foundation sample and an additional yard sample (see SOP #UA-F-5.0) will be collected, stored and recorded independently, although they will be sampled during the same visit and the collection will be recorded on the same soil sampling data sheet (Fig. 1).

4.2 The foundation soil sample will be collected within six inches of the line where the residential foundation enters the soil. Different stainless steel trowels will be used to collect the foundation and the yard soil samples. The yard soil sample will be collected 10 feet $\pm$ 1 foot from the location of the foundation soil, perpendicular to the wall of the building. Both soil samples are composite (by type) and are collected on all four sides of the respondent's home. The Chain of Custody Record is stamped on the paper bag in which the Ziploc Freezer bag is kept.

4.3 The foundation sample will be processed for analysis to determine metal and pesticide content upon return to the Field Office. Proper sample collection, custody and handling procedures must be of primary concern to all field staff. Ziploc bags will be transported to the field at room temperature in the HH bucket. Once the sample is collected, it is stored in a cooler on blue-ice until it returns to the lab where it is stored in a freezer at -20°C.

5.0 RESPONSIBILITIES

5.1 The Field Coordinator is responsible for:

(a) 100% QA check of field forms;
(b) Accepting custody of soil sample from the Team Leader;
(c) Transferral of sample to the Lab Coordinator;
(d) Performing 10% QA in-field audit of collection, transportation and storage methods.

5.2 The Team Leader is responsible for:

(a) arranging sampling dates and times with the HH;
(b) selecting the sample sites at each HH;
(c) custody of the soil samples and supplementary data collected;
(d) completing the Chain of Custody Record (Fig. 2);
(e) quality control checks in the field.
(f) transfer of sample to the Field Coordinator.

5.3 All Team Members are responsible for:

(a) obtaining the soil samples according to protocol;

(b) properly storing and labeling the collected sample;
(c) completing the Soil Sampling Data Sheet (Fig. 1);
(d) quality control checks in the field.

6.0 MATERIALS AND REAGENTS

6.1 Materials

Sample storage containers (Ziploc Freezer Bags), indelible ink pen, 30 yard measuring tape, two stainless steel trowels, sample storage cooler, blue ice-packs, Soil Sampling Data Sheet, paper bag with the Chain of Custody Record stamped on it, kim wipes and deionized water.

6.2 Reagents

Deionized water to rinse and clean the trowel after use.

7.0 PROCEDURE

7.1 Preparation

7.1.1 Field Site Selection Criteria

Indicate on the field sheet whether each sample site chosen is within the bounds of the field site selection criteria. Criteria include:

(a) Foundation soil samples are collected along the foundation, within six inches of the wall of the home, on the property of the participants. Permission must be granted by the HH respondents to collect the soil - check with the Team Leader to see if the respondents would prefer you **not** to sample in certain areas, and avoid sampling those areas whenever possible.

(b) Since the Foundation Soil sample location determines where the Yard Soil sample will be collected (SOP UA-F-5.0), attempt to choose a Foundation Soil sample site which would also allow you to collect Yard Soil samples. That is, be sure that your Foundation Soil site has a potential Yard soil site perpendicular to and 10 feet ± 1 foot away from the site whenever possible.

(c) If the residence is an apartment, or multiple family dwelling unit, sample at the base of the building as if it were a single family housing unit. Annotate the building type and any consequential effects on sample site selection on the field sheet.

(d) If a sample is to be taken by the side of a road

or near a driveway, exercise extreme caution, be wary of traffic flows, and be conscious of your surroundings.

(e) If the sample is to be collected in a part of the yard in which vegetation is dense or your view is partially obscured, be aware of environmental hazards such as scorpions, snakes, etc.

(f) Try to avoid sampling in pools of standing water, cat litter boxes etc. Note any unusual characteristics of the sample site in the comments section of the Soil Sampling Data Sheet. Comments might include references to nearby fuel or chemical spills, drainage or rain run-off patterns, etc.

7.1.2 Reagents - none.

7.1.3 Standards & Blanks

One out of twenty Ziploc freezer bags is randomly chosen and marked by the Materials Tech as a **Field Blank.** This bag is sealed and randomly assigned to a HH to be brought into the field as a blank. A second Ziploc freezer bag out of the batch of twenty is randomly chosen and marked by the Materials Tech as a **Lab Blank.** The Lab Blank is stored in the field area under the same conditions as the other soil sample containers. Lab Blanks and Field Blanks are analyzed routinely.

7.1.4 Samples

The Field Kit and Bucket must be stocked with appropriate materials, specifically - sample storage containers, indelible ink pens, two trowels, a 30 yard measuring tape, kim wipes and deionized water. The particular Soil Sampling Data Sheet and Chain of Custody Record (stamped on the paper bag which houses the Ziploc bag) for the HH to be sampled should be in the HH bucket. Additional Sampling Data Sheets and Chain of Custody Records are available in the Field Kit.

7.2 Sample Collection

The data/sample flow diagram for composite soil samples is shown in Figure 5. The relative timing of soil sampling to other sample collection by stage is displayed in Figure 6.

7.2.1 Blanks deployed

The sample container randomly assigned by the Materials Tech as a Field Blank is also randomly assigned to a Household and transported to the field. It experiences the same storage and shipment conditions as the other soil sample containers but is returned unexposed and unopened. It is analyzed with the other soil samples.

7.2.2 Samples

The Team Leader coordinates with, and obtains consent from, respondents in each HH.

7.2.3 Residential foundation composite soil samples will be collected at the four sides of the house. Sites and commentary will be recorded on the data sheet.

(a) Before starting sampling or immediately after completing, label the sample containers (Ziploc Freezer Bags) with indelible ink; include the sample type, HHID, sample ID, date, and collector's ID.
(b) Clean the stainless steel trowel by rinsing with deionized water and drying with kim wipes.
(c) Walk around the house and determine the sampling sites. If there are less than eight possible sampling locations, make sure to take enough soil at each remaining site so the total sampling mass will approximate the mass that would have been collected by sampling at eight locations.
(d) On each side of the house, divide (by eye) the length of the wall (as if it were straight) into three approximately equal units.
(e) Collect a soil sample at the 1/3 and 2/3 point, within six inches of the foundation line (where the wall of the building meets the soil) (Fig.3 a,b and Fig. 4 a,b).
(f) Record the sites on the sampling data sheet (Fig.1).

7.2.4 Residential foundation soil samples are collected as a composite sample. The total of eight samples (2 front,2 rear,2 at each side) are collected and held in the same sampling container. At each of the eight sites:

(a) Carefully clear the area of the sampling site of large gravel/debris/leaves etc.
(b) Collect 1 trowel load of soil up to a Max. of 1 inch depth.
(c) Open the sample container and place the sample within.
(d) Re-seal container and replace removed gravel etc.

(e) Move to next sampling site.
(f) Use the same trowel for all eight soil samples. Do not use the same trowel in collecting the foundation soil that you used when collecting the yard soil samples without rinsing it thoroughly with deionized water and drying it with kim wipes first.
(g) It is recommended that you use one cleaned stainless steel trowel for the foundation soil and a second trowel for the yard soil.

7.2.5 Since the yard soil and foundation soil are collected at the same time by the same Field Team Member and the sample sites are 10 feet ± 1 foot distant and perpendicular to each other, it is recommended that sampling occur according to the following sequence:
(a) Collect foundation soil at site '1' with trowel 'A'.
(b) Move 10 feet perpendicular to site '1'.
(c) Collect yard soil at site 1" with trowel 'B'.
(d) Move to the next foundation soil sampling location and repeat a-c in 7.2.5.

7.2.6 When the eighth and final foundation soil sample has been collected:
(a) Clean hands.
(b) Complete the appropriate sections of the Soil Sampling Data Sheet (Fig.1).
(c) Notify Team Leader that soil sampling is complete.
(d) Store the sample in the cooler on blue ice.

7.2.7 When the field team returns from the field:
(a) The collector relinquishes the samples to the Team Leader.
(b) The Team Leader transfers custody to the Field Coordinator or freezer.
(c) The change is documented.
(d) The Field Coordinator, Materials Technician or Delegate places the samples in the freezer. If the Field Coordinator is not present, the samples are stored in the freezer by the Team Leader who transfers custody to the Field Coordinator as soon as possible.
(e) The Field Coordinator transfers custody to Lab Supervisor for sieving, analysis and shipment to cooperating laboratories for analysis.

7.3 Calculations

Calculations are limited to estimating the length of a side of a house and dividing that approximate length into 3 equal portions. The tape measure is available for verification if needed. Distance from the wall of the home at the foundation is also estimated; however, visual estimation of distance and depth is acceptable.

7.4 Quality Control

7.4.1
(a) 10 percent of all samples will be used for Qa/Qc purposes.
(b) In the HH sampling site the Team Leader supervises all work and completion of forms. Team Members work collectively and check each other's work for accuracy, precision and compliance with SOP procedure and policy.
(c) The "comments" section on the data sheet must be completed, if necessary. Examples of situations which might violate sample quality include: soil under gravel, cement on sampling area, sample taken after rain, strong winds while sampling, or grass included with the sample, etc..
(d) The Field Coordinator supervises 1 out of 10 houses sampled to insure that the proper collection methods are used.

7.4.2 Tolerance Limits

Estimation of the length of a dwelling and its subdivision into three equal segments may be accomplished by eye. When measurement is not necessary in cases where unusual circumstances influence sampling, notify the Team Leader of the situation and document the decision on the Soil Sampling Data Sheet (Fig. 1). Distance from the wall is to be no greater than 6 inches, plus or minus one inch. Insure that the trowel does no penetrate the soil to a depth greater than one inch +/- 1/2 inch. Depth may be approximated by the Field Team.

7.4.3 Detection Limits

Collect a sample wherever possible. If the sample site has no soil overlay, such as on a tile, brick, or cement surface, collect the dust/dirt if possible and document the nature of the ground covering as appropriate. Document possible sources of metal or pesticide contamination where visually detected.

7.4.4 Corrective Actions

Apparent mis-labeling 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 Soil Sampling Data Sheet

8.1.1 This data sheet (Fig.1) will serve as the primary record of both foundation soil and yard soil samples collected in the field. The soil sample collector is responsible for the thorough completion of this form.

8.1.2 The completed original Soil Sampling Data Sheet will be securely archived with the HH packet upon completion of post field QA checks to be accomplished by the Team Leader and Field QA Coordinator.

8.2 Chain of Custody Record

8.2.1 This Record (Fig.2) will serve as the primary record of sample custody after collection in the field. The Team Leader and the collector are responsible for the thorough completion of this form.

8.2.2 The completed original Chain of Custody Record will remain with the soil sample at all times. The Chain of Custody form UA-G4-1.0 (version 1) is stamped on the paper bag in which the Ziploc soil container is placed (Fig. 2)

8.3 Sample

8.3.1 The sample container (Ziploc bag) will also have HHID, Date, sample type, sample ID and collector's initials recorded upon it with indelible ink.

8.3.2 The original Chain of Custody Record will remain with the sample regardless of where it is shipped or stored.

Figure 1. Soil Sampling Data Sheet. (page 1 of 2)

SOIL SAMPLING

Form Type: 104
FORM UA-F-5.0-1.0

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

Stage # ☐

Collapsed? Y ○ N ○ 8 ○

Team Leader: ____ Init. Tech ID ☐☐

Collected by: ____ Init. Tech ID ☐☐

HHID ☐☐☐☐☐☐ F.S. ☐ Visit ☐

Sample Date ☐☐ / ☐☐ / ☐☐ (MO / DAY / YR) QC: ✓ [ ]

1. Collection Start Time: ☐☐:☐☐ 2. Collection Stop Time: ☐☐:☐☐ QC: ✓ [ ]

Site #	Foundation Soil	QC:✓	Comments	Yard Soil	QC:✓	Comments
1	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
2	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
3	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
4	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
5	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
6	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
7	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
8	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
9	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐
10	○ Y ○ N ○ N/A	[ ]	☐☐	○ Y ○ N ○ N/A	[ ]	☐☐

3. Foundation Soil Sample ID: 53☐☐☐☐☐ QC:✓ [ ]

4. Yard Soil Sample ID: 51☐☐☐☐☐ [ ]

QC ✓ By: ____ Init. Tech ID ☐☐

Comments: ____

Data Use Only: 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ A ○ B ○ C ○ D ○ E ○ F ○ G ○ H ○ I ○ J ○

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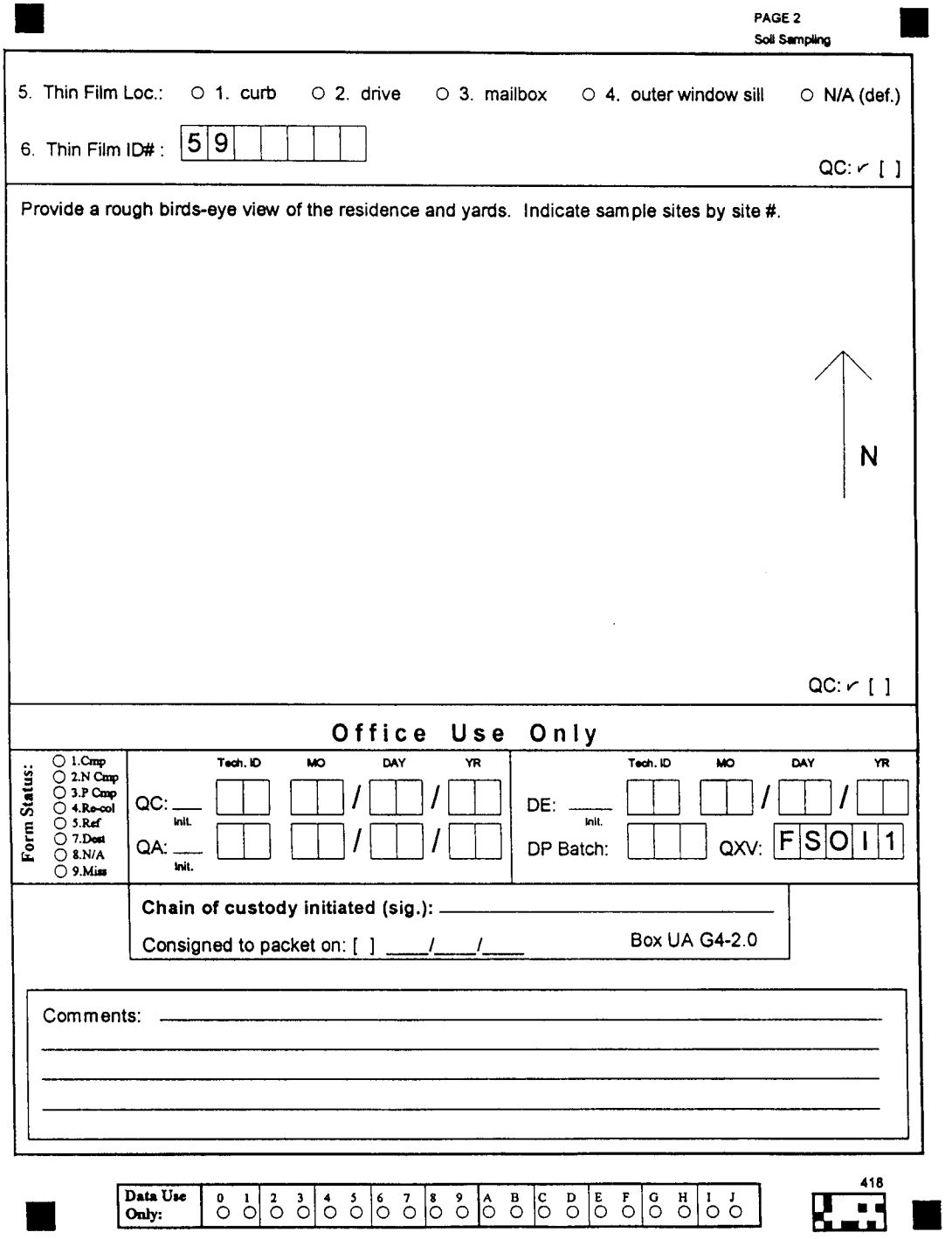
Figure 1. Soil Sampling Data Sheet. (page 2 of 2)



PAGE 2
Soil Sampling

5. Thin Film Loc.: ○ 1. curb ○ 2. drive ○ 3. mailbox ○ 4. outer window sill ○ N/A (def.)

6. Thin Film ID# : 5 9

QC: ✓ [ ]

Provide a rough birds-eye view of the residence and yards. Indicate sample sites by site #.

N

QC: ✓ [ ]

Office Use Only

Form Status: ○ 1.Cmp ○ 2.N Cmp ○ 3.P Cmp ○ 4.Re-col ○ 5.Ref ○ 7.Dest ○ 8.N/A ○ 9.Miss

QC: ___ Init. Tech. ID MO / DAY / YR

QA: ___ Init. Tech. ID MO / DAY / YR

DE: ___ Init. Tech. ID MO / DAY / YR

DP Batch: QXV: F S O I 1

Chain of custody initiated (sig.): _____

Consigned to packet on: [ ] ____/____/____ Box UA G4-2.0

Comments: _____

Data Use Only: 0 1 | 2 3 | 4 5 | 6 7 | 8 9 | A B | C D | E F | G H | I J

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Figure 2. Chain of Custody Record for Soil Samples.

Chain of Custody Record
NHEXAS Arizona Project (CR-821560)
Respiratory Sciences
1435 N. Fremont
Tucson, AZ 85719
(602) 626-4226

Sample Type:_____

Received By:_____/_____
print signature

Date Received	Time	Sample ID	# of Containers	Remarks

Relinquished by (signature)			Received by (signature)		
Name	Date	Time	Name	Date	Time

Comments:

Figure 3a. Sampling Sites

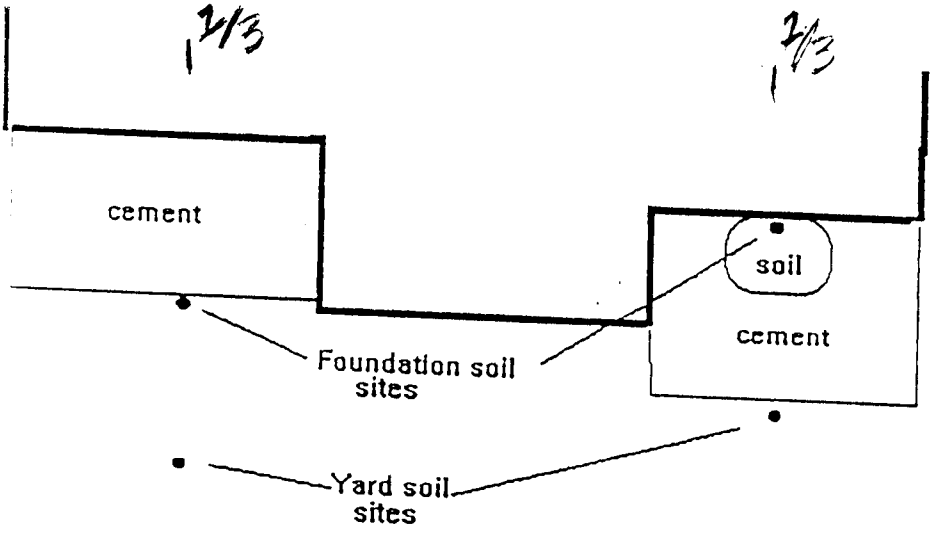

Figure 3b. Sampling Sites

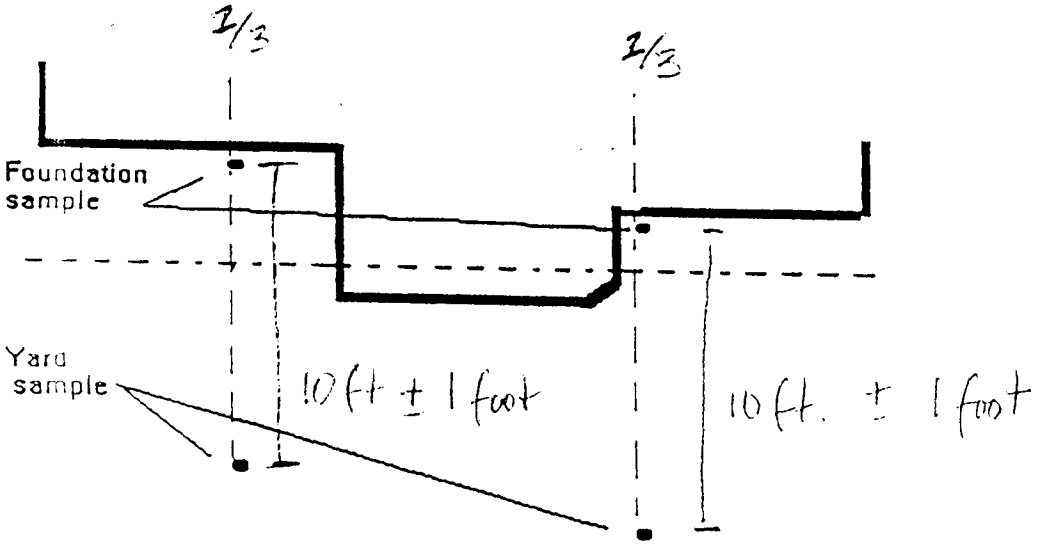

Figure 4a.Example of sampling sites for a single family dwelling.

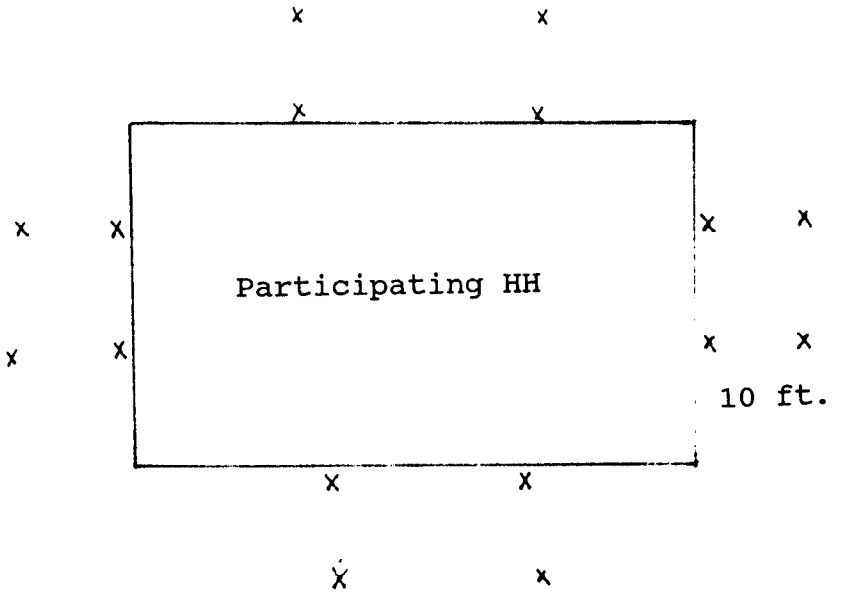

Figure 4b.Example of sampling sites for a multi-family dwelling or apartment

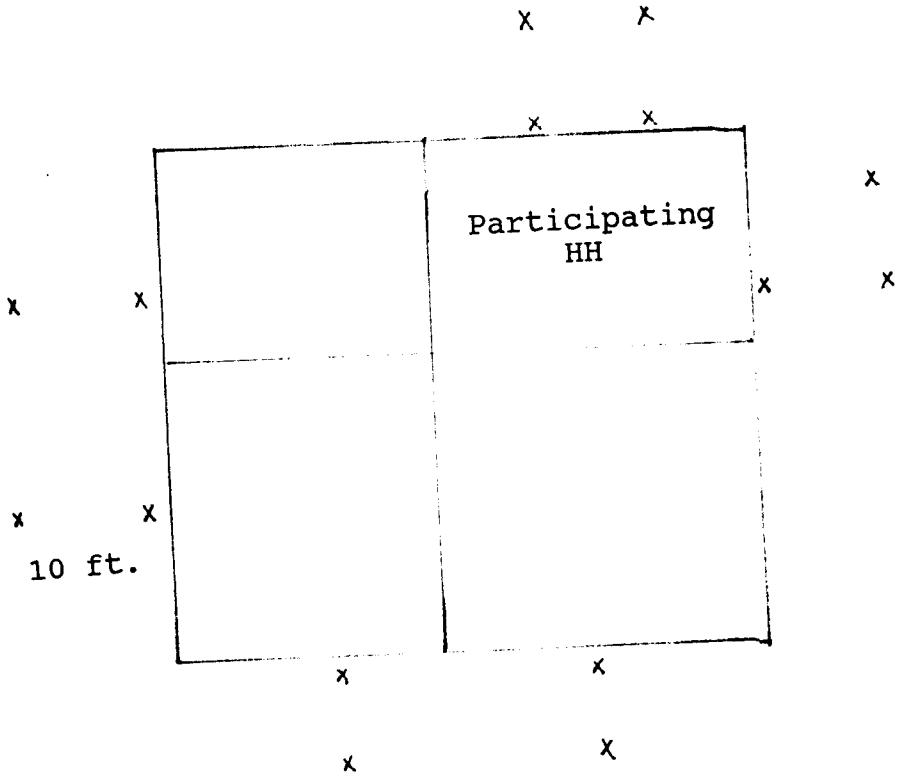

Figure 5. Data/Sample flow Diagram for Yard and Foundation Composite Soil Samples.

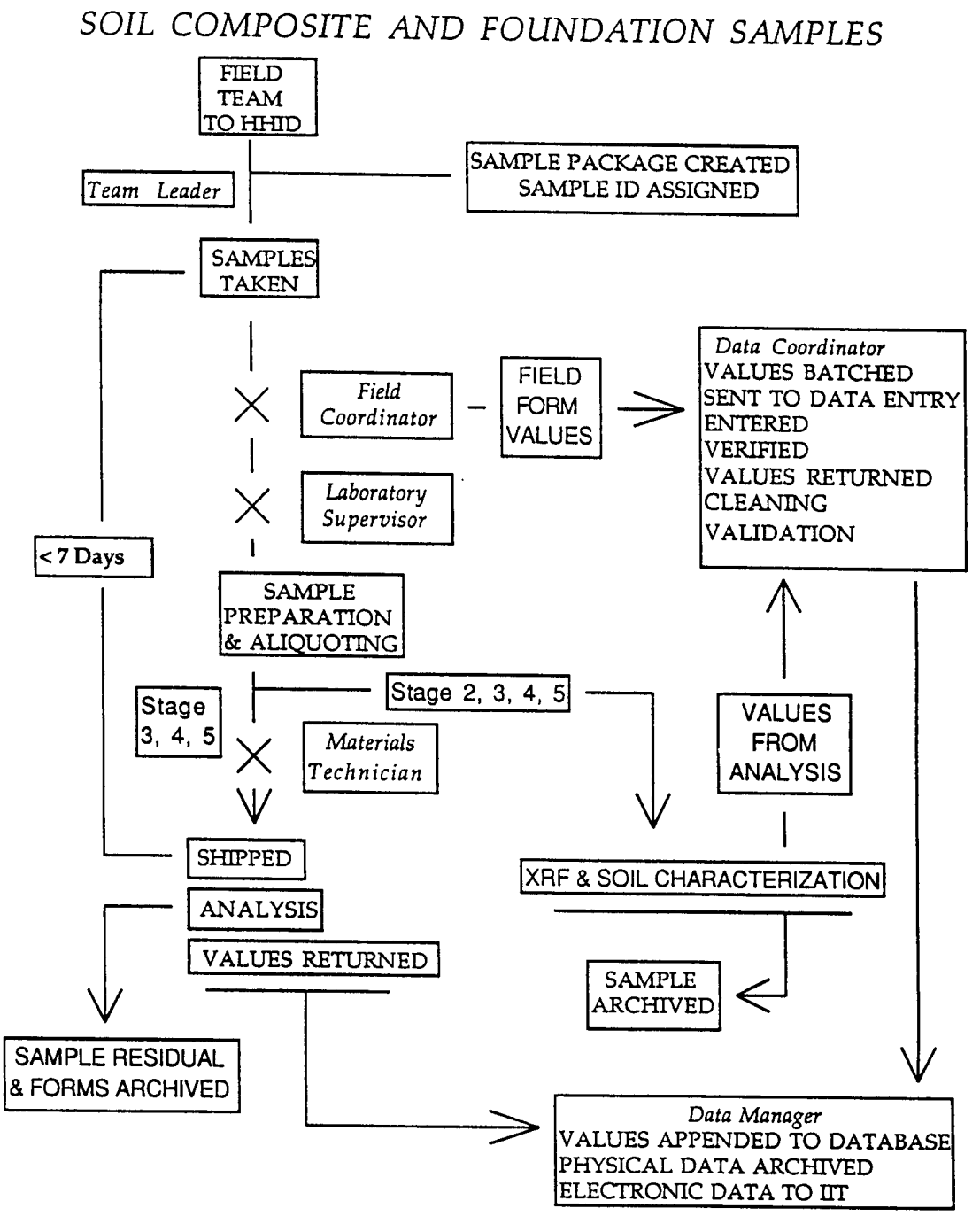

Figure 6. Relative Timing of Soil Sample Collection by Stage. (page 1 of 2)

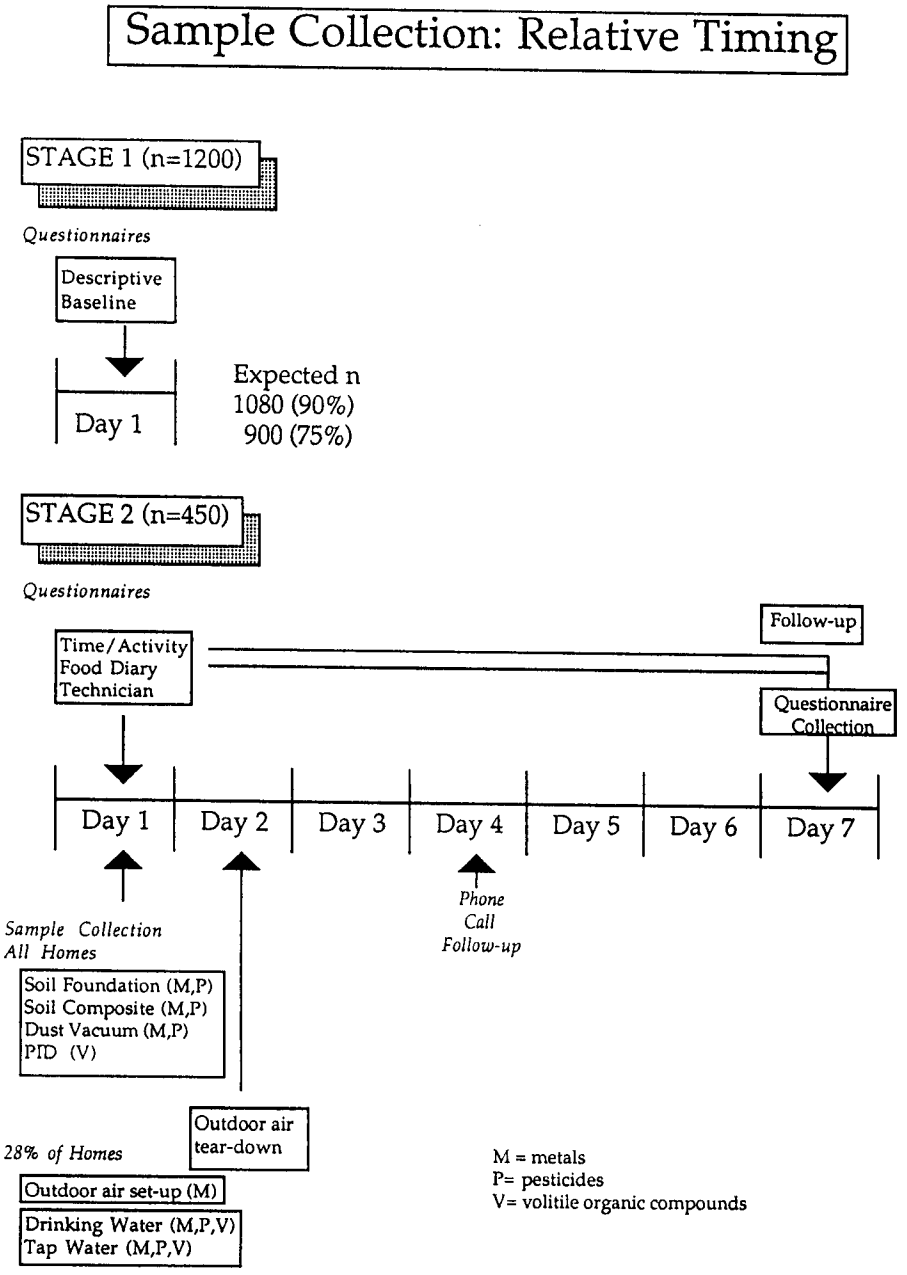

Figure 6. Relative Timing of Soil Sample Collection by Stage. (page 2 of 2)

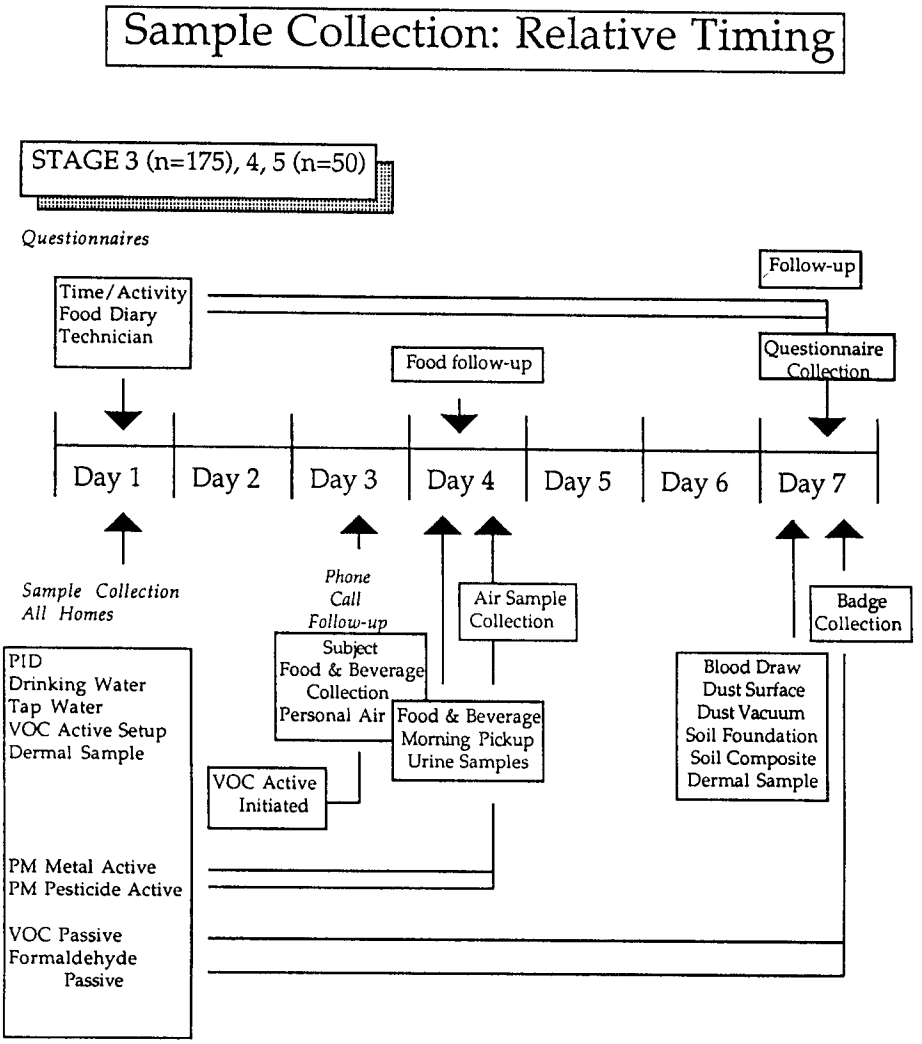

Figure 7. Field Notes and Troubleshooting Guide for Foundation Soil Sample Collection

1) Collect two samples from each side of the home up to a maximum of eight samples.