

# The Arizona Border Study

*An Extension of the  
Arizona National Human Exposure Assessment Survey (NHEXAS) Study  
Sponsored by the Environmental Health Workgroup of the Border XXI Program*

## Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona  
Tucson, Arizona 85721

Cooperative Agreement CR 824719

**Standard Operating Procedure**

**SOP-UA-F-16.1**

**Title:** Collection, Storage, and Shipment of Drinking and Tap Water  
Samples for Trace Metals Analysis

**Source:** The University of Arizona

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

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**Title: Collection, storage and shipment of drinking and tap water samples for trace metals (EPA Method 200.8)**

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## APPROVALS

☒ Full SOP    ☐ Working SOP    #pages 715

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Project QA Director:

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## **Collection, Storage, and Shipment of Drinking and Tap Water Samples for Trace Metals Analysis**

### **1.0 PURPOSE AND APPLICABILITY**

The procedures in this SOP describe how to collect, store, and ship tap and drinking water samples for analysis by EPA Method 200.8 (revision 4.4) for the NHEXAS Arizona project, AZ Border project, and other Health and Environment projects. This SOP provides a brief description of the sample containers, collection, preservation, storage, shipping, and custody procedures.

### **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. 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 room temperature tolerant samples to and from the field.
- 2.3 DRINKING WATER: Any water used for drinking. This includes tap water that is treated, or filtered, and water brought into the home from an outside source and used for drinking.
- 2.4 FIELD COORDINATOR = The employee of the research project who supervises field data collection and operations. The Field Coordinator collates individual data into HH packets, and upon completion of all visits, sampling and QA checks, forwards the packet to the Data Coordinator.
- 2.5 FIELD STAFF = The Field Coordinator, the Team Leader and the Team Members.
- 2.6 LAB SUPERVISOR = The employee of the research project who supervises laboratory analyses.
- 2.7 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.

- 2.8 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.
- 2.9 QUALITY ASSURANCE (QA) = All those planned and systematic actions necessary for ensuring the accuracy, validity, integrity, preservation and utility of collected data.
- 2.10 QUALITY CONTROL (QC) = Those quality assurance actions providing a means to control and measure the characteristics of a datum, process or the adherence to established parameters.
- 2.11 RESPONDENT = A person in the study population of NHEXAS Arizona project, AZ border and other Health and Environment projects. Each household is assigned an HHID. All respondents are assigned an Individual Respondent Number (IRN). Each respondent can be uniquely identified by an HHID, IRN combination.
- 2.12 SAMPLE = The water collected from the household for trace metals analysis.
- 2.13 SAMPLE IDENTIFICATION NUMBER = A numeric code that uniquely identifies every sample. It is generated by the NHEXAS tracking system by the Materials Technician.
- 2.14 TAP WATER = Untreated or softened water passing through the kitchen tap after removal of aerators, filters, or other attachments at the tap.
- 2.15 TEAM LEADER = The member of the field team who is primarily responsible for respondent contact, data collection, field forms and questionnaire completion, and site QC checks of all data.
- 2.16 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.
- 2.17 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.
- 2.18 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.
- 3.2 Long, S.E. and Martin, T.D. 1991. Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma - Mass Spectrometry (Method 200.8, revision 4.4). Environmental Monitoring Systems Laboratory Office of Research and Development, U.S. EPA.

### **4.0 DISCUSSION**

- 4.1 Presence of chlorine presents no problem for sample analysis. Water collected for H<sub>2</sub>O analysis is transported from the field on blue-ice and stored at 4°C for Field Team convenience and consistency only. Samples are shipped to the analyzing lab at room temperature.
- 4.2 If a house has one untreated water source, only one tap water sample will be collected. If separate tap and drinking water sources are used, tap water and a sample from the most frequently consumed drinking water source will be collected for trace metals analysis.
- 4.3 The relative timing of water sample collection to other sampling types by stage is shown in Fig. 2.

### **5.0 RESPONSIBILITIES**

- 5.1 The Field Coordinator is responsible for:
  - (a) knowing the procedures described in this SOP and insuring that they are followed by the Field Staff,
  - (b) supervising the set-up and collection of water samples in one out of every ten houses sampled as a field audit for QA,
  - (c) coordinating with the Materials Technician to ensure that water sample containers have been logged in to the Tracking System and assigned to HH as appropriate,
  - (d) QA check of the Water Sampling Field Sheet within 24 hours of collection.
- 5.2 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 household,
- (c) obtaining the water containers from the Materials Technician,
- (d) collaborating with the Team Member(s) to select the appropriate sampling site at each household,
- (e) insuring the integrity and custody of the water sample and field forms collected,
- (f) quality control checks in the field,
- (g) properly storing the water samples in the dark at 4°C to and from the Field sites in the HH Bucket,
- (h) forwarding individual QC checked field forms to the Field Coordinator for QA check within 24 hours of collection.

5.3 All Team Member(s) are responsible for:

- (a) knowing and following the procedures described in this SOP,
- (b) receiving the water containers from the Team Leader,
- (c) collaborating with the Team Leader to select the appropriate sampling site at each HH,
- (d) obtaining the water samples according to this SOP,
- (e) completing the Water Sampling Sheet and the Chain of Custody Record,
- (f) quality control (QC) checks in the field.

5.4 The Materials Technician is responsible for:

- (a) the proper assignment of water containers to selected HH,
- (b) accepting custody of the water containers from the Team Leader and annotating the receipt in the Chain of Custody Record that accompanies the sample,
- (c) properly storing the water containers in the dark at 4°C after receipt,
- (d) stocking the HH Bucket with appropriate field sampling forms,
- (e) including Field Blanks with water container assignment as appropriate.
- (f) Shipping the samples collected to the analyzing laboratory at room temperature and documenting shipment on the Chain of Custody Record and on the NHEXAS Arizona (or other project) Shipment Log (Fig. 5).

## 6.0 MATERIALS AND EQUIPMENT

6.1 Materials:

- (a) 1000 mL Trace Clean HDPE Cubitainer (VWR) with foam-lined closure.
- (b) electrical tape or parafilm
- (c) plastic funnel

- (d) paper towels
- (e) 'Type 1' high purity, high resistivity water purchased from VWR for Field Blanks.

## **7.0 PROCEDURE**

### **7.1 Preparation**

#### **7.1.1 Containers**

The cubitainers, with teflon caps, will be purchased pre-cleaned from VWR, and meet EPA specifications for use of water containers in metals sampling.

#### **7.1.2 Identifying water sources**

Have the participants identify the primary drinking water source that the Primary Respondent uses. If multiple drinking water sources are used by the Primary Respondent identify secondary sources and prepare to sample.

### **7.2 Sample Collection**

#### **7.2.1 Water Delivery Systems**

- a. For tap water samples, run the water at high flow for at least three minutes before collecting. The temperature of the water should stabilize before sampling.
- b. Remove any aeration devices before collecting tap water samples. Be sure to line outer edge of aeration device with electrical or teflon tape before removal to prevent damage to outer surface of aerator housing.
- c. Collect a second sample if there is a second "source" of water for dish washing, drinking, cooking, or bathing. A second source includes any water delivery system which contains a separate in-line filter.
- d. If modified tap water (i.e., drinking H<sub>2</sub>O) is used for drinking, do not remove any filters present at the tap (do not bypass any water softening systems). Run water for at least 3 minutes before collecting samples.
- e. If a water source is bottled, do not run water prior to sample collection.
- f. If a water source is hand pumped from a well, pump for at least three minutes before sample collection.

### 7.2.2 Sampling

- a. Reduce the flow rate of the water to avoid introducing bubbles in the sample (or pour slowly from a drinking water storage container). Use the funnel to direct the flow of the water into the collection container as necessary.
- b. Fill the cubitainer with 500 mL of water; do not pre-rinse the containers. When the water level exceeds the midpoint crease on the collapsible cubitainer, sufficient sample, i.e. > 500 mL, has been collected.
- c. Carefully compress the cubitainer to expel excess air in the container. Take care not to lose any sample.
- d. Cap, seal with parafilm or electrical tape and transport to the field office in a cooler on blue ice. The water sample for metals analysis is transported to the field office on blue-ice for uniformity in field collection procedures only.
- e. Clean-up any spills with paper towels as necessary.

### 7.3 Sample Storage

7.3.1 Immediately place the samples in darkened storage at 4°C upon return to the field office.

7.3.2 The sample must be kept away from direct light until analysis.

### 7.4 Sample Delivery or Shipment

7.4.1 All samples will be chilled to 4°C prior to shipping as they are temporarily stored with other more volatile water samples collected at a given HH.

7.4.2 Complete the NHEXAS AZ (or other project) Shipment log and document shipment on the Chain of Custody Record. Retain a copy of the Chain of Custody records and Shipment Log. Forward a second copy of the Chain of Custody Record and Shipment Log to U.S. EPA Labs in Cincinnati. The original Chain of Custody Record and shipment log remains with the sample(s).

7.4.3 Ship or transport the sample at room temperature in insulated shipping containers to the respective analyzing laboratory. Specific instructions for packaging and preparing samples for shipment are given in Figure 6.



7.4.4 Transport the samples using the quickest possible method conforming to all DOT (Department of Transportation), express mail packaging and shipping regulations.

## 7.5 Analysis and Calculations

None

## 7.6 Quality Control

7.6.1 5% of all samples will be accompanied by a Field Blank. A sample container filled with high purity Type 1. water purchased from VWR will be taken to and returned from the field and sent with actual samples for analysis.

7.6.2 Duplicate samples will be collected in 5% of the homes.

7.6.3 10% of all samples collected/analyzed are for QC/QA purposes.

7.6.4 Samples must be stored away from sunlight at room temperature or lower.

7.6.5 Samples must be sent to the analyzing agency within 2 weeks for acidification. Once acidified the samples may be held up to 6 months before analysis.

## 8.0 Records

8.1 The water collection data sheet and chain of custody record must be completed for all samples (Figure 1).

8.2 The original copy of each form remains with the sample at all times.

8.3 A photo-copy of each form is retained with the household sampling packet.

Figure 1. Water collection Sampling Sheet and chain of custody record.

Sample Protocol and Chain of Custody Sheet NHEXAS Arizona Water Sample				
Sample ID# : _____		HHID: _____		
Collection Date: ____/____/____		Collection Time ____:____		
Water Source : Municipal, surface _____ Municipal, well _____ Private _____ Bottled water _____ Other _____				
Collection Location: Kitchen Tap: _____ Other _____				
Water sample type: Drinking(only) _____ Tap(only) _____ Drinking=Tap _____				
Sample type: Pesticides _____ Carbaryl _____ VOCs _____ Metals _____ (525.2) (531.1) (524.2) (200.8)				
Residual chlorine measurement: Residual chlorine = _____ ppm				
Quencher: Sodium Sulfite (pests) : # vials added = _____ or N/A Ascorbic Acid (VOCs) : # vials added = _____ or N/A Sodium Thiosulfate (carb): # vials added = _____ or N/A				
Preservative added: HCl Yes [ ] or No [ ] pH less than 2 Yes [ ] or No [ ]				# Containers = [ ]
Storage Conditions : Field: _____ Lab: _____				
Collection Comments: _____ _____ _____				
Custody Record				
Relinquished or Recieved	Signature	Date mo./day/yr.	Time	Action
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	
[Rel] [Rec]		____/____/____	____:____	

Other Comments:

FORM = UA-F16.0-1.0

Figure 2. Relative Timing of Sample Collection by Stage (page 1 of 3).

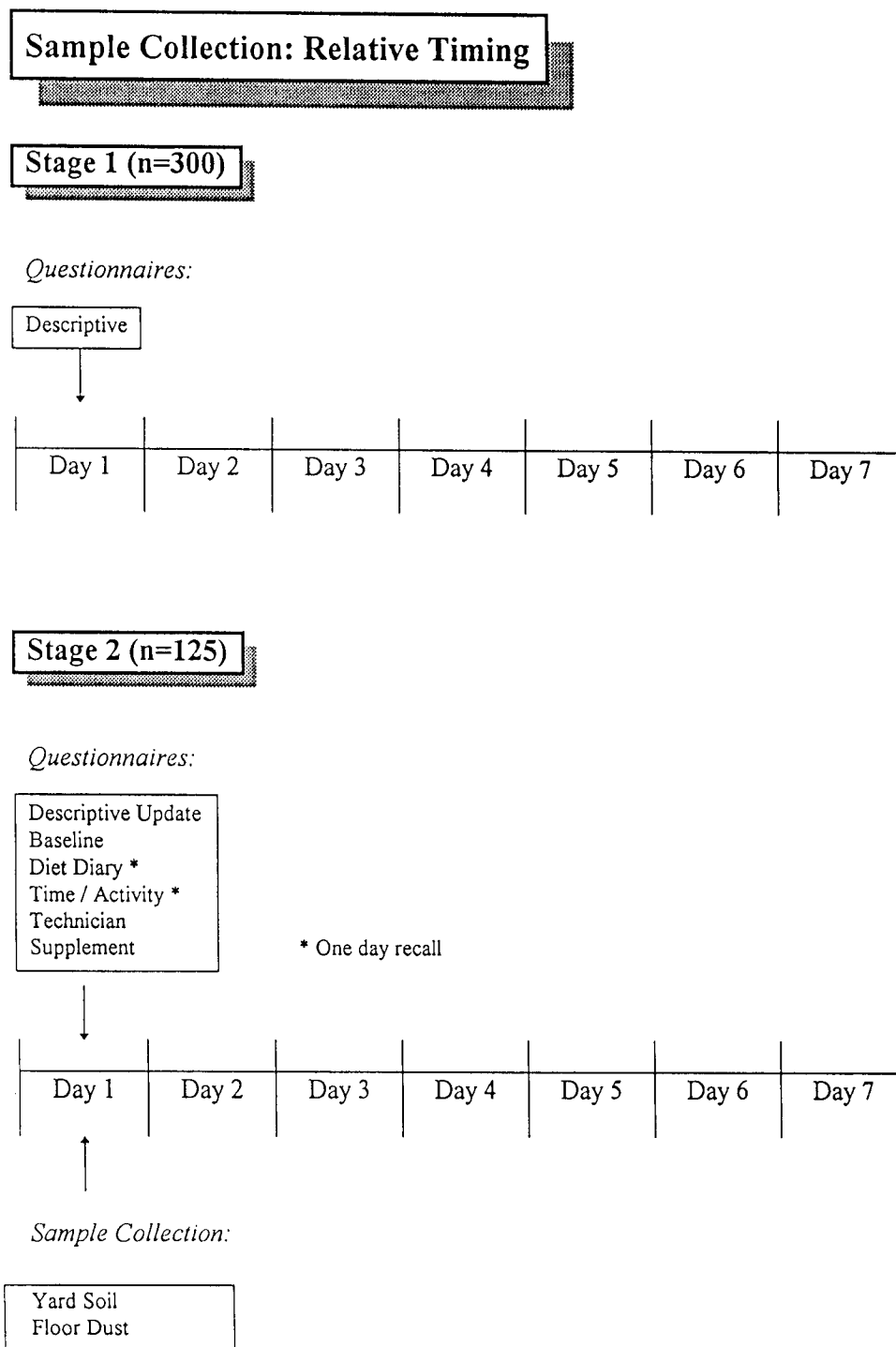
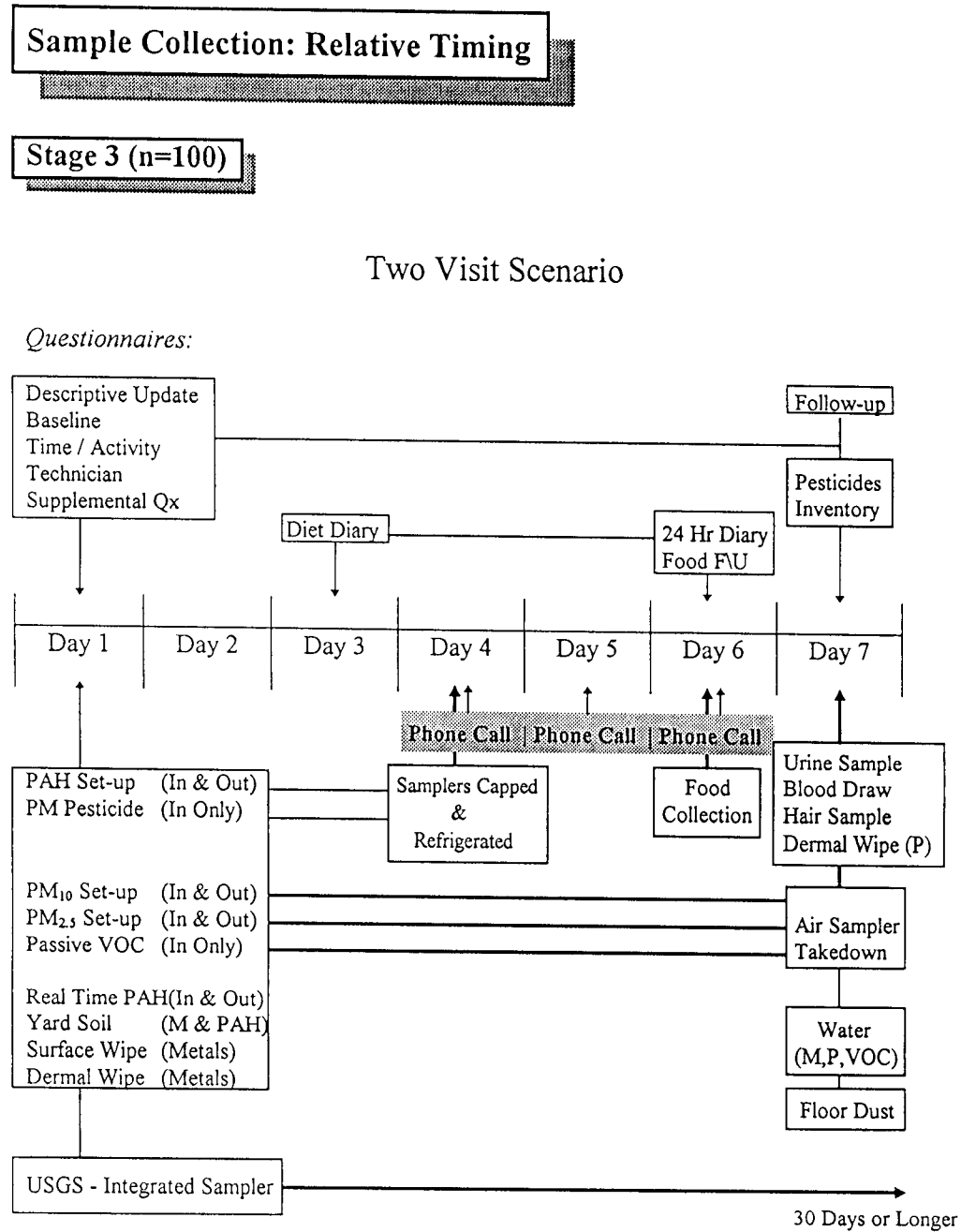
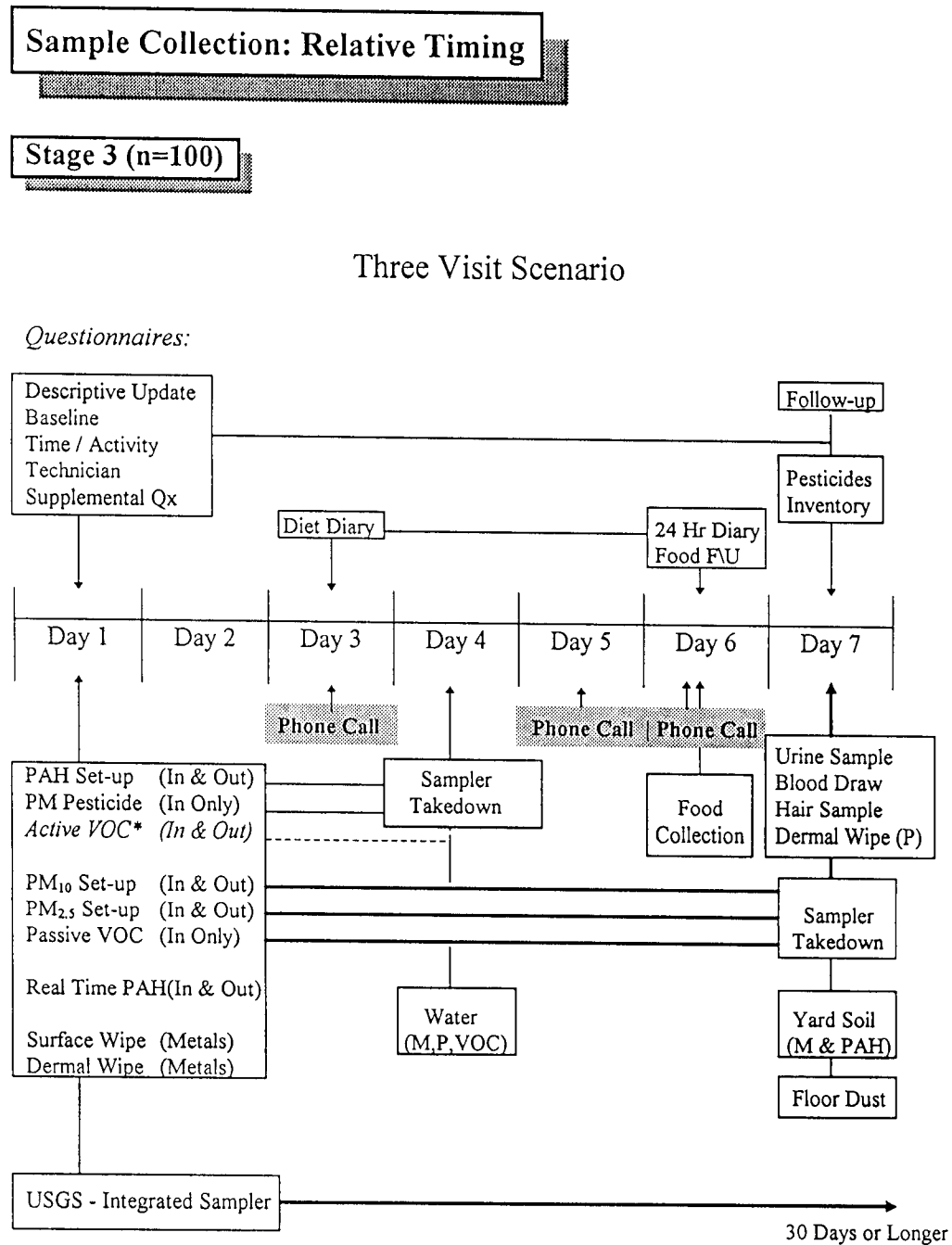


Figure 2. Relative Timing of Sample Collection by Stage (page 2 of 3).



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

Figure 2. Relative Timing of Sample Collection by Stage (page 3 of 3).



**Figure 3. Field Note and Trouble Shooting Guide.**

No field notes or Troubleshooting guides are currently on record for UA-F-16.X. Additions will be appended and the SOP reviewed and updated in accordance with UA-G-1.X as appropriate.

Figure 4. Handling Water Samples.

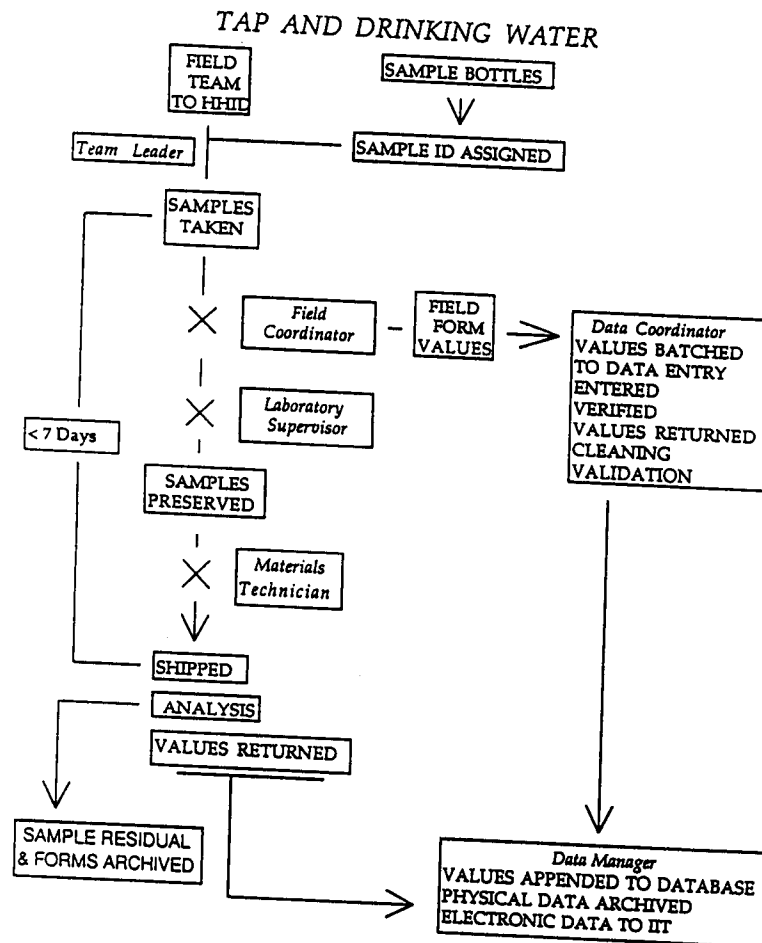


Figure 5. NHEXAS AZ Shipment Log.

**NHEXAS Az SHIPMENT LOG**

Shipment Date     /    /     Destination                                  Shipment prepared by       
Recipient Notified of Shipment by      on     /    /     comments                                 

*note: FF = field form included with shipment and CoC = chain of custody record verified and present*

SAMPLE ID#	TYPE	FF	CoC	COMMENTS

FORM ID = UA-F-16-13



**Figure 6.      Specific Instructions For Sample Packaging and Preparation for Shipment.**

1.      Wrap EACH sample in small bubble wrap individually.
2.      In a large Ziploc bag place the following items:
  - a.      Each of the pre-wrapped tubes,
  - b.      Custody sheets in a small separate Ziploc for protection in case of breakage.
3.      Seal the ziplock bag with the contained articles
4.      Find a biomailer of the appropriate size.
5.      Sprinkle in Styrofoam "Peanuts" until bottom of biomailer is covered to a depth of one to two inches. Please note that these should be "free", unconstrained peanuts not those already packed in a plastic bag.
6.      Place the sample bag described above on top of the peanuts.
7.      Cover the sample bags with peanuts.
8.      Seal and mail the package via OVERNIGHT transportation.