

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-T-2.0

Title: Administering Field Questionnaires--General

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: ADMINISTERING FIELD QUESTIONNAIRES - GENERAL

Document No. UA-T-2.0

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Full SOP Working SOP #pages 13

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Administering Field Questionnaires- General

1.0 PURPOSE AND APPLICABILITY

The purpose of this SOP is to outline the objectives of and instructions for questionnaire administration in order to ensure consistency among the instructions given to respondents in the field. This procedure must be followed to ensure consistent data custody, storage, transfer and analysis of a high quality for the NHEXAS Arizona Project of the University of Arizona/Battelle/Illinois Institute of Technology Consortium.

Border and other Health +
Environment
ESG
7.14.97

2.0 DEFINITIONS

- 2.1 **BATCH** = A collection of individual completed HH packets which have been collated for the purpose of tracking. The HH packets are sent as a batch to be entered into the electronic database, verified and cleaned. The Data Coordinator "batches" packets received from the Field Coordinator.
- 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 samples to and from the field through the course of the study.
- 2.3 **CHAIN OF CUSTODY RECORD** = A vital data tracking and quality assurance form which is attached to every field sampling data sheet.
- 2.4 **DATA COORDINATOR** = The employee of the research project who supervises data batching, entry, and verification.
- 2.5 **FIELD** = The sampling environment or the site at which data will be collected. This is almost always at the residence of the primary respondent.
- 2.6 **FIELD KIT** = A sampling tool-box containing appropriate collection and storage utensils.
- 2.7 **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.
- 2.8 **FORM, PHYSICAL** = The paper or "hard copy" original of the data which is collected in the field. Form is also a generic term for any piece of paper data, such as records and check sheets, questionnaires, etc., which are collected for analysis.
- 2.9 **HOUSEHOLD(HH)** = The residence occupied by study respondents.
- 2.10 **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.
- 2.11 MATERIALS TECHNICIAN = The employee of the research project who is responsible for assembling and assigning field forms, questionnaires and equipment for field use.
- 2.12 N/A = Not Applicable.
- 2.13 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.
- 2.14 QUALITY ASSURANCE(QA) = All those planned and systematic actions necessary for ensuring the accuracy, validity, integrity, preservation and utility of collected data.
- 2.15 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.
- 2.16 SAMPLE = That piece of physical data which is collected from the study participants for the purpose of scientific analysis.
- 2.17 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.
- 2.18 TEAM MEMBER = The member of a field team responsible for assisting the team leader in the collection of data and quality control checks in the field.
- 2.19 TRACKING SYSTEM = A database system containing information about the custody, transfer and storage of hard copy data, electronic data, field samples, and field sample aliquots.
- 2.20 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 Burrows, B and et al. 1971. Year one: of Specialized Center of Research (unpublished). Respiratory Sciences Center, College of Medicine, University of Arizona, Tucson, AZ.
- 3.2 Questionnaire Instruction. 1986. Study of Health and the Environment, Respiratory Sciences Center, College of Medicine, University of Arizona, Tucson, AZ. Survey 0 (unpublished).
- 3.3 Lebowitz, M.D. 1993. Study Design (Revision of 31 Dec. 1993). EPA NHEXAS Cooperative Agreement.

4.0 DISCUSSION

- 4.1.1 Questionnaires are given to each subject who agrees to participate in the Study. The Descriptive Questionnaire will be administered,

one per household, upon enrollment into the study population. One Baseline QX will be administered to the Primary Respondent by a field Team Member. All other questionnaires are designed for self-completion by the project participants. If a subject is unable to complete his/her own questionnaires due to age, or any other condition a parent, guardian or other person is asked to complete the questionnaires for him/her. The Team Leader may record the responses of a study participant in their diary if this is requested by the participant.

4.1.2 Confidentiality of subject identity requires the assignment of identification numbers (SOP# UA-G-3.0 and UA-F-1.0). Access to subject identity is limited to the project Field Coordinator, field personnel, and the project Data Coordinator as needed. Each questionnaire collected is consistently labeled with the household number and Individual Respondent Number(IRN) (SOP# UA-F-1.0). All references to the individual are made using the HHID, IRN, and first name only (not the family name).

4.1.3 Field Team members are trained in the administration of questionnaires by the project Field Coordinator, and the project Principal Investigator. Training is accomplished through the use of mock interviews, video-taped interview sessions and direct instruction. The QxQ (see appendix A) is also used in training and throughout the project. This document provides detailed information on the rationale and statistical purposes and intent of each question administered to study respondents in the NHEXAS AZ project. A bound copy of the QxQ is carried in the field by Field Team Leaders should problems arise during questionnaire administration.

5.0 RESPONSIBILITIES

5.1 The Materials Technician is responsible for preparing the HH Bucket with sufficient questionnaires and field sampling materials so that the Field Team may successfully complete the sampling of a given HH. The Field Coordinator will instruct the Materials Technician as to the number and types of questionnaires to include at least 3 days before the Bucket is required (see UA-F-2.0).

5.2 The Team Leader is responsible for:

- (a) questionnaire administration as applicable,
- (b) instructing the participant on how to complete a questionnaire,
- (c) QC checks of the questionnaire in a household to facilitate subject completion of the questionnaire,
- (d) knowing and following the procedures described in this SOP.

5.3 The project Field Coordinator is responsible for:

- (a) insuring this SOP is followed by Team Leaders and Interviewers,
- (b) training field Team Members. Some training will occur in the field in a hands-on setting,
- (c) all task assignments for the Team Members,

- (d) QA checks of questionnaires.
- (e) Notifying the Materials Technician of the sampling requirements
and materials to include in a HH Bucket at least 3 days
prior to sampling (see UA-F-2.0).
- 5.4 The local Co-Principal Investigator will be responsible for final review and approval of each procedure.

6.0 MATERIALS AND REAGENTS

6.1 Materials

HHID Label
Survey Questionnaires
Black ink pen
Red ink pen
Post-its
Portable Tape Recorder and Audio Tapes

6.2 Reagents - N/A

7.0 PROCEDURE

7.1 Preparation

7.1.1 Standards and Blanks

Extra copies of each questionnaire are carried by the Field Team in the Field Kit, and will be used as needed.

7.1.2 Samplers

The Materials Technician prepares the household's sampling items (SOP# UA-F-2.0) according to the survey design. The Questionnaires required include:

- (a) Descriptive Qx (one per Household)
- (b) Baseline Qx (one per Person)
- (c) Time activity Qx (one per Person)
- (d) Food Diary (one per Person)
- (e) Food Follow-up (one per Person)
- (g) Follow-up Qx (one per Person)
- (h) Technician Qx (one per Household)

Each Qx is pre-labeled with the HHID and the IRN.

7.2 Procedure Description

- 7.2.1 The Demographic Qx will be administered to the first adult contact in the HH.
- 7.2.2 The Baseline Qx will be administered to the primary respondent. The primary respondent self-completes all other Qx. The Team Leader will obtain the consent of the primary respondent to tape the

administration of the Baseline Questionnaire. If consent is given, the Team Leader will record the Questionnaire administration by stating the date, time, HHID, IRN and first name of the primary respondent before commencing the interview. A second field team member will QA check the written responses in the questionnaire against the spoken responses of the respondent upon return to the field office within 24 hours of questionnaire administration. If consent to tape the interview is not given, the administration of the questionnaire will not be taped.

7.2.3 All other Subjects are requested to complete the individual level survey questionnaires. The Team Leader reminds Subject(s) that each questionnaire contains crucial information about the Subject's activities and exposures. The Team Leader briefly explains the intent of each questionnaire and explains the method of completion.

ON 11/16/95 SQ

7.2.4 The Team Leader verifies that a HHID label is ^Aeach form. If the label is missing, the Team Leader records the assigned HHID on the questionnaire in pen or with an extra HHID label. If the HHID is incorrect, the Team Leader marks through the incorrect number with the black pen once and records the correct number on the Qx. All changes made must be initialed and dated by the Team Member making the change. (see SOP UA-C-2.0).

7.2.5 The Team Leader records the first name of the Subject, and his/her assigned IRN (SOP# UA-F-1.0) as it was assigned at the first contact on the Demographic Questionnaire. If this is the first contact, the Team Leader follows the instructions listed in the Demographic Qx.

7.2.6 The Team Leader instructs the Subject(s) to call if they have any problems or questions, and circles the field office phone # on the front cover of the questionnaire as a reference for the subjects.

7.2.7 The Team Leader displays instructions and definitions on the cover of each questionnaire. The subjects may refer to these in the event of confusion or questions after the visit is completed.

7.2.8 The Team Leader assists each subject in completing any questionnaires for the survey as necessary.

7.2.9 The Team Leader stresses the importance of the information provided by each questionnaire, and answers any immediate questions before continuing with the next sampling procedure.

7.3 Calculations - N/A

7.4 Quality Control

7.4.1 Tolerance Limits

All questionnaires assigned to a Household or and individual respondent will be QC checked by the Team Leader. Each Qx will be

labeled as completed, refused by the IRN as applicable. There is zero tolerance of non-compliance with these two criteria by Field Team Leaders. A second team member will review the audio tape record of the interview as appropriate. The response on the audio tape will be compared against the response recorded in the questionnaire for accuracy and completion.

7.4.2 Detection Limits - N/A

7.4.3 Corrective Actions

In Field

- (a) While in the HH, the Team Leader checks the Qx for completion. If retrievable information is missing, the Team Leader records the data obtained in red ink and dates and initials the change. (see UA-C-2.0).
- (b) Each questionnaire has For Office Use Only boxes throughout the text of the questionnaire. The Team Leader may use these boxes to record information, comments, events, and questions, etc., which might relate to the overall quality of the data contained in each questionnaire. The Questionnaire Feedback Form (fig. 2) is completed on administered questionnaires only. Currently, the Descriptive Questionnaire, the Baseline Questionnaire (primary respondent only) and possibly the Follow-Up Questionnaire are the only administered questionnaires in NHEXAS AZ. (see UA-T-1.0)

Post Field

- (c) The Team Leader performs a second post-field visit QC check within 24 hours of collection. If retrievable information is missing, the Team Leader contacts the Subject by phone and records the data obtained in red ink.
- (d) The Team Leader records the status of the Qx by circling the appropriate option in the completion box on the back outer cover of each questionnaire (Fig. 1).
- (e) A second Field Team member provides an independent QA check by comparing the written responses with those recorded on the tape of the interview.
- (f) The Qx is forwarded to the Project Field Coordinator for QA check within 24 hours of collection.
- (g) The Project Field Coordinator reviews Qx data.
- (h) Any unanswered questions are reviewed with the Field Team Leader.
- (i) If further missing data can be obtained from the Subject,

the Team Leader will contact the subject and record the data in red ink.

(j) When the QA check is completed and all issues have been resolved, the project Field Coordinator signs the appropriate custody receipt areas on the form (Fig. 1).

(k) The Project Field Coordinator assembles the packet and forwards it to the Project Data Coordinator. (see SOP UA-C-4.0)

8.0 RECORDS

8.1 The "For Office Use Only" (see Figure 1) box is printed on the outer cover of each questionnaire. The completion status of each questionnaire and the transfer of custody from the Team Leader to the Field Coordinator and its subsequent transfer to the HH packet are recorded in this box.

8.2 The Questionnaire Feedback Form

- (a) This form is completed by an Interviewer or Team Member after they have administered a questionnaire to a respondent.
- (b) The form allows for subjective feedback on the relative "quality" of the interview and questionnaire in general forms.
- (c) The form is to be completed after the questionnaire has been administered and the Team has left the household. The Feedback form is not to be completed in the homes of respondents under any conditions.

8.3 The QxQ summary of the rationale, statistical use and any necessary clarifications for each individual question in each questionnaire is carried in the field by the Field Team Leader. This document is reviewed during initial training and as needed ^{to} during the field season for NHEXAS AZ. The document is appended ^{to} this SOP and is called Appendix A: QxQ NHEXAS AZ.

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Figure 1. For Office Use Only Box on all Questionnaires.

Office Use Only																					
Status Code:	1	2	3	4	5	6	7	8	9	0	A	B	C	D	E	F	G	H	I	J	
QC:	Tech. ID MO DAY YR										Tech. ID MO DAY YR										
QA:	Init. / _____ / _____ / _____										Init. / _____ / _____ / _____										
	DE: _____ / _____ / _____										DP Batch: _____ / _____ / _____										
											QXV: Q D E S 1										
<p>Public reporting burden for this collection of information is estimated to average 15 minutes per completion, and to require 0 hours recordkeeping. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Chief, Information Policy Branch, 2136, U.S. Environmental Protection Agency, 401 M St., S.W., Washington, D.C. 20460, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503. OMB Clearance #: PENDING</p>																					
<p>NHEXAS Form ID: UA-T-1.0-3.0</p>																					
Data use only:	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>									

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Figure 2. Questionnaire Feedback Form

QUESTIONNAIRE FEEDBACK FORM
 National Human Exposure Assessment Survey

Form type 09 Study <input type="radio"/> 1 NHEXAS <input type="radio"/> 2 Border <input type="radio"/> 3 _____ <input type="radio"/> 4 _____ <input type="radio"/> 5 _____	Stage #: <input type="text"/> <input checked="" type="checkbox"/> Collapsed? Y N g <input type="radio"/> <input type="radio"/> <input type="radio"/>	<input type="radio"/> 1. Descriptive <input type="radio"/> 2. Baseline <input type="radio"/> 3. Follow-Up <input type="radio"/> 4. _____	HHID <input type="text"/> F.S. <input type="text"/> IRN # <input type="text"/>
		Tech ID <input type="text"/> Admin. by: Int. <input type="text"/>	QA QC Code <input type="text"/>
1. Respondent First Name: <input type="text"/>			
2. Number of interruptions: <input type="radio"/> None <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> More than 5			
3. Number of clarifications offered: <input type="radio"/> None <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> More than 5			
4. Respondent attitude: <input type="radio"/> Poor <input type="radio"/> Fair <input type="radio"/> Good <input type="radio"/> Very Good <input type="radio"/> Excellent			
5. Respondent interest: <input type="radio"/> Poor <input type="radio"/> Fair <input type="radio"/> Good <input type="radio"/> Very Good <input type="radio"/> Excellent			
6. Overall quality of interview: <input type="radio"/> Poor <input type="radio"/> Fair <input type="radio"/> Good <input type="radio"/> Very Good <input type="radio"/> Excellent			
7. Interview conducted in: <input type="radio"/> 1. English Stop. <input type="radio"/> 2. Spanish Go to Q #8 below. <input type="radio"/> 3. Other Indicate language (to right) and then go to Q #8 below. Language: <input type="text"/> Lang. Code: <input type="text"/>			
8. Indicate the interpreter: <input type="radio"/> 1. NHEXAS Field Team Member Stop. <input type="radio"/> 2. Hired Interpreter Full Name: _____ <input type="radio"/> 3. HH Resident Go to Q #9 below. <input type="radio"/> 4. Other Go to Q #10 below. <input type="radio"/> 88. Not applicable (Default Code)			
9. First name: <input type="text"/> IRN #: <input type="text"/>		10. First name: <input type="text"/> Age: <input type="text"/>	
Comments / Events / Observations: <input type="text"/> <input type="text"/> <input type="text"/>			

Office Use Only

Status Code: 1 2 3 4 5 6 7 8 9	Tech. ID <input type="text"/> MO <input type="text"/> DAY <input type="text"/> YR <input type="text"/> QC: <input type="text"/> Init. <input type="text"/> QA: <input type="text"/> Init. <input type="text"/>	Tech. ID <input type="text"/> MO <input type="text"/> DAY <input type="text"/> YR <input type="text"/> DE: <input type="text"/> Init. <input type="text"/> DP Batch: <input type="text"/> QFED1
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Figure 3: Field Notes and Troubleshooting Guide

No field notes or Troubleshooting guides are currently on record for UA-T-2.0. Additions will be appended and the SOP reviewed and updated in accordance with UA-G-1.0 as appropriate.

Figure 4: Timelines and Relative Timing of Sample Collection (page 1 of 2)

Sample Collection: Relative Timing

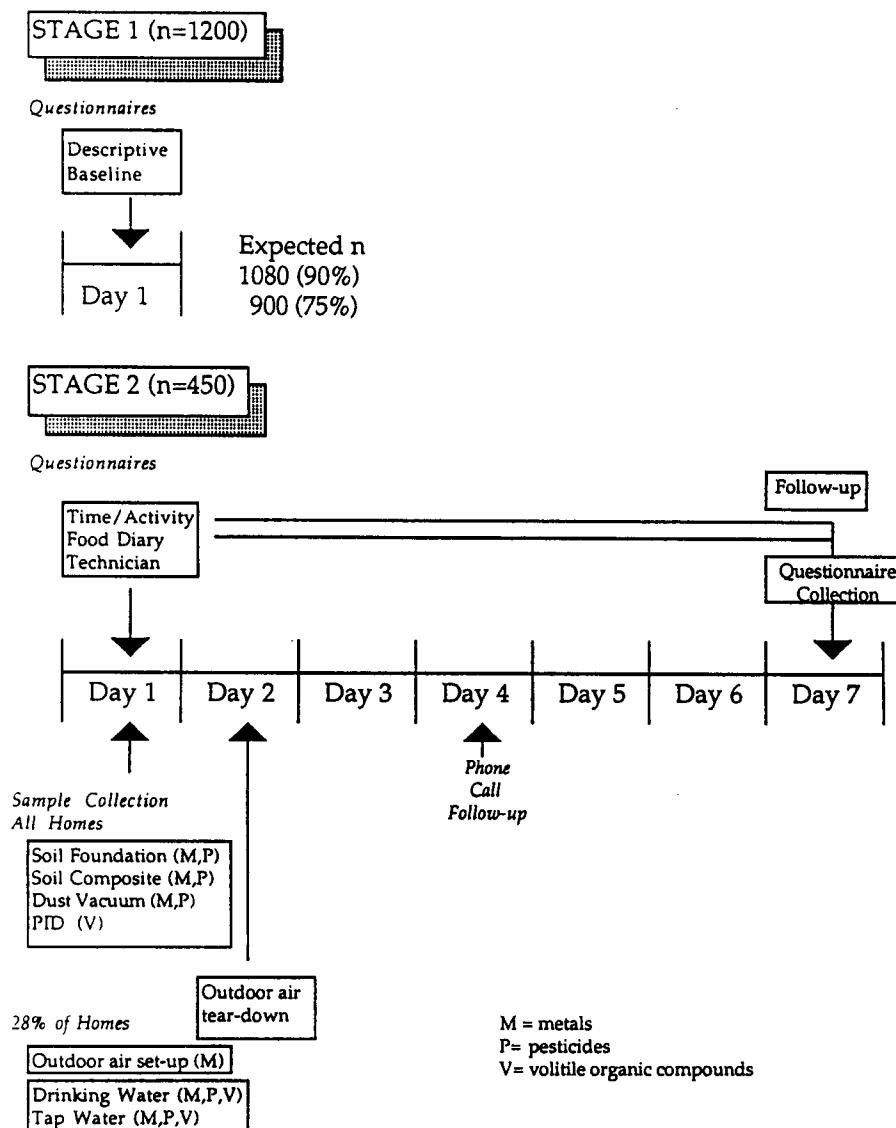
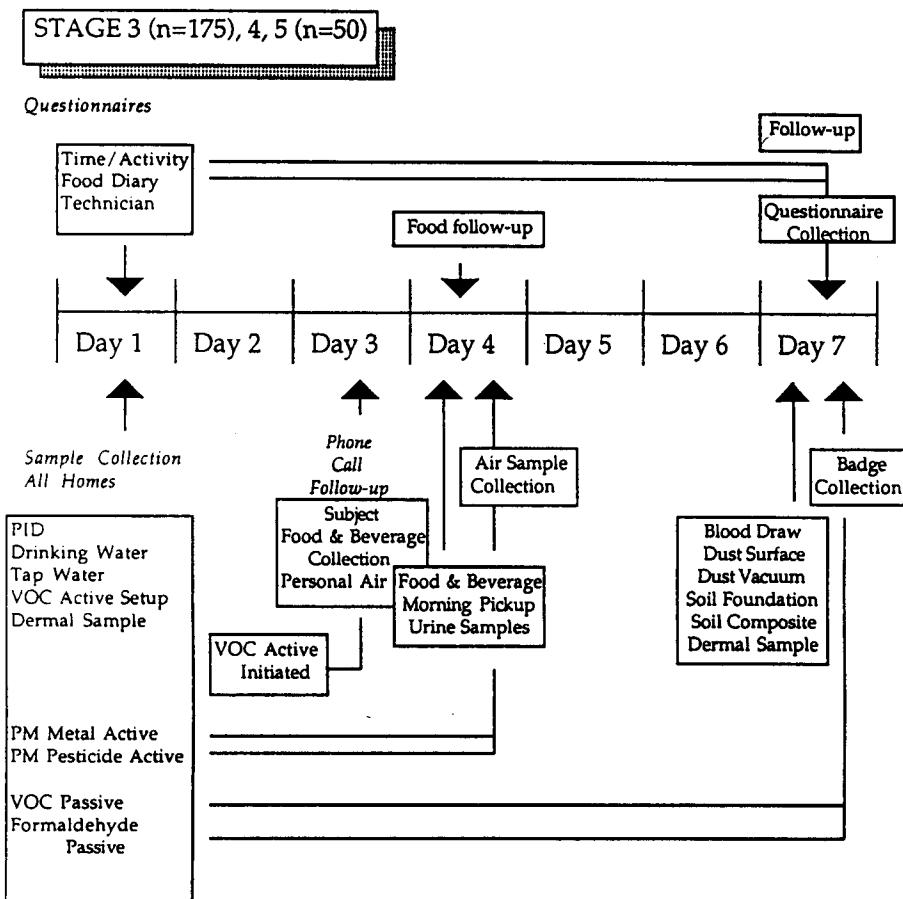


Figure 4: Timelines and Relative Timing of Sample Collection (page 2 of 2)

Sample Collection: Relative Timing



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Appendix A: QxQ NHEXAS AZ

The NHEXAS QxQ is currently being revised (July 1995). Modifications will update the existing draft to address changes made to the final versions of the questionnaires to be used in the NHEXAS Project. The modified version of the QxQ will be submitted for review as soon as possible.

The QxQ draft (51 PAGES) attached to this SOP was current as of 1 March 1995.

NHEXAS QxQ
Version Current as of
1 March 1995

Q x Q - NHEXAS ARIZONA

Introduction:

This document has been prepared to facilitate consistent questionnaire administration in the NHEXAS AZ project. The document is used in the training of field team members and may be consulted at any time during the course of the project. Information contained in the Q x Q has been culled and condensed from various other sources. A significant portion of the information presented is drawn from the rationale documents for each questionnaire provided by _____.

The Q x Q provides the Field Team Members with essential information as to the intent of each question on every questionnaire administered in the NHEXAS AZ project. In addition to providing background information as to the purpose of each question, it also describes permissible clarifications and re-statements which the team leader may use when administering the questionnaire to a respondent should the need arise. The Q x Q also alerts Field Team Members to potential situations where respondents may misinterpret a particular question due to some local or cultural nuance which might otherwise go unnoticed.

In short, the goal of this document is to provide Team Members with common definitions, clarifications, and possible restatements for each question in the suite of questionnaires used in the NHEXAS AZ project. Consistent data collection techniques are essential for comparability within the NHEXAS AZ project and between the various NHEXAS consortia.

All three NHEXAS Phase I Field Studies will use the same questionnaire. This was developed by EPA in cooperation with a number of recognized experts in the collection of human activity data related to pollutant exposure. This questionnaire was developed to: 1) provide descriptive information for the households and individuals included in the NHEXAS population sample compared with the target population (e.g., Census data), 2) to explain variability or predict differences in exposure/dose measurements, 3) to identify the presence (and, possibly, usage patterns) for major pollutant sources in the microenvironments most frequently visited by individuals in the survey (e.g., home and workplace); and 4) to characterize the distributions of "exposure factors" which are often used to develop exposure scenarios for risk assessments.

To meet these objectives, the questionnaire was designed to elicit information about each of the following topic areas: a) demographic characteristics of household residents and of selected respondent(s), b) basic household characteristics, c) lifestyle factors for the selected respondent, d) occupation of the respondent, e) general dietary patterns, f) non-dietary ingestion, and g) health status.

Approach:

An expert panel was assembled, composed of experts from various disciplines, including: exposure assessment--air, exposure assessment--non-air media, questionnaire and survey design, and environmental epidemiology. The primary focus of the effort, at this stage, was to identify what information was needed, and could be collected, to support exposure assessment/analysis. A

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draft version of a NHEXAS general questionnaire was developed to elicit information about each of the following topic areas:

- a) demographic characteristics of household residents and of selected respondent(s),
- b) basic household characteristics,
- c) lifestyle factors for the selected respondent,
- d) occupation of the respondent,
- e) general dietary patterns,
- f) non-dietary ingestion, and
- g) health status.

The identification of approaches for collecting diary data for detailed (daily) time-location and activity patterns, and for daily dietary patterns and a dietary history, were specifically NOT included in this effort.

The General Questionnaire was split into four sub-questionnaires for simplicity in administration (to minimize respondent burden and maximize participation rates at each step) and for collecting information that can be temporally related to the exposure, concentration and/or biological measurements collected in NHEXAS. The four sub-questionnaires are:

- 1) descriptive, to enumerate individuals within a household, to identify general characteristics of the living quarters and occupants, and to provide a basis for assessing potential bias due to refusals in subsequent steps;
- 2) baseline, to provide more detailed information on the characteristics of the sample individuals and housing, and on the usual frequency of activities over a longer time frame (i.e., last month or year);
- 3) technician, to identify and inventory the presence of pollutant sources and document physical characteristics of the building (to minimize burden on respondents); and
- 4) follow-up, to provide information on activities during the sampling period to explain variation in the sample (or differences between sub-groups) for the monitoring results.

Descriptive Questionnaire

This questionnaire is designed to be the first completed by the potential survey participant. The questionnaire enumerates basic household characteristics and provides for certain comparisons with Census characteristics. The instrument is kept short in order to maximize participation so that at least some information can be gathered on most of the selected sample.

One use of this questionnaire is to provide an opportunity to introduce the subsequent monitoring study and recruit participation into that portion of the survey. The Descriptive Questionnaire can also be used in conjunction with a method for randomly identifying a household member in order to select a probability sample of individuals for personal monitoring.

The questionnaire will be completed in person, using a survey professional.

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2) Baseline Questionnaire

This longer questionnaire is designed to gather detailed information from the designated respondents on their households. The designated respondents would have been previously identified using the Descriptive Questionnaire. The Baseline Questionnaire collects information on demographic characteristics of the respondent and their household, more detailed data on basic housing characteristics, information on the use of consumer products that may influence pollutant exposures, and enough information on lifestyle and occupational classification to categorize the respondent and in some cases determine the potential for certain exposures. The baseline questionnaire will be administered to the primary respondent in the household. Other members of the household will self-complete the questionnaire during the sampling week.

3) Technician Questionnaire

This questionnaire contains detailed questions about housing information and must be completed by a trained NHEXAS technician at the residence of the designated respondent. A trained technician is necessary because the items contained in the questionnaire may not be reliably completed by the resident, even with an in-person interviewer. The first portion of this questionnaire is completed by the technician with the designated respondent present to show the technician to the various locations in the house. The technician may then independently complete measurements, take inventories, and set up monitoring equipment.

Questionnaires of this type have proven to be an invaluable tool in tracking household respondents in multi-stage, repeat visit research projects run through our research office our previous occasions.

4) Follow-up Questionnaire

This questionnaire is to be administered at the conclusion of the residential and personal monitoring and is used to assess whether particular activities occurred or products were used during the time period when the monitoring was conducted. The time interval for this questionnaire will correspond to that of the monitors. This questionnaire is designed for self-administration and it is assumed that it will be completed by the respondent at the time the technician returns to disassemble and pick up the monitoring equipment.

All background and demographic questions in the draft NHEXAS questionnaires have at least five justifications for their inclusion:

- 1) The questions collect information, relating to basic characteristics, that is necessary to place the other NHEXAS responses in some sort of meaningful context. For example, does this respondent come from a simple or complex, usual or unusual type of household?

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- 2) These characteristics have been defined and measured by the Census Bureau and their population values and distributions are known. This data base makes it possible to compare the NHEXAS sample with U.S. and regional population characteristics and to identify groups that may be over or under-represented.
- 3) In a related way, having these Census data make it possible to adjust and weight (post-stratify) the NHEXAS sample so that it is generalizable to the regional U.S. populations within known error limits.
- 4) Having this basic demographic and lifestyle information for as large a sample as possible enables estimation of potential nonresponse bias among the respondents at subsequent stages of monitoring and allows statistical adjustment of the analysis weights to decrease the potential for nonresponse bias.
- 5) Background and demographic information will be used to identify possible causes of differences of exposures and to develop testable hypotheses for follow-up studies. These could involve hypotheses of differential levels of exposure across subsets of the population, differential levels of exposure based on lifestyle and activities, and relationships between exposure variables.

DESCRIPTIVE QUESTIONNAIRE

Question D1:

Verify address on label. Circle "1" or record corrected address below.

Rationale:

This item is needed to ensure that the interviewer has located the correct sample household and that the monitoring team will be able to return to this same household, if participating.

Question D2:

Verify that the respondent is a resident of the household and is at least 18 years old.

Rationale:

This item is needed to ensure that we are talking to the type of person to whom the remaining questions are directed.

Question D3 :

Is this property a vacation or second home where you live less than half the year or is this your primary residence?

Rationale:

This item is needed to establish eligibility of the household for further participation.

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Question D4:

Do 10 or more people live at this address?

Rationale:

This item is needed to establish eligibility of the household for further participation.

Question D5:

Is this (house or apartment) a group quarters?

Rationale:

This item is needed to establish eligibility of the household for further participation. This question is designed to identify addresses where 10 or more unrelated people live together. The design of NHEXAS Phase I focusses on sampling of primary residences. Institutions such as hospitals, nursing homes, military bases and prisons are excluded from the sampling frame. These institutions are excluded for many reasons: they usually have transient populations; permission to sample may be difficult to obtain; there may be special state laws governing institutions that will interfere with the conduct of the study. In some cases, adults may not be competent to provide informed consent to participation in the study. The exclusion of an address with 10 or more unrelated individuals is a way to exclude most of these institutions. There may be a few group homes for 10 or more people that are not institutions that will be inadvertently omitted by this screening question, but this is unlikely because such homes represent a very small percentage of all residents. Because of this exclusion, the results of the survey must be described as not applying to permanent residents of institutions or to permanent residents of group homes of 10 or more people.

Clarification:

Group quarters indicates a household composed of unrelated individuals.

Question D6a-b:

Enter the first names of each person in Column B of the Roster.

Rationale:

Asked mainly to have each individual in the household uniquely identified in order to choose one person at random to serve as a primary respondent. This question also serves to define household size, which is needed to weight the sample properly.

Clarification:

Are there any other individuals, roommates, etc. currently living here?

Question D6c:

Indicate the sex of each person.

Rationale:

To identify each person's gender for sample selection purposes. Item is needed to assess whether differential participation rates occur for males and females.

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Question D6d:

What is (NAME's) year of birth?

Rationale:

To describe each resident's age. Item will allow an assessment of whether differential participation or response occurs as a function of age (e.g., of respondent or of head of household).

Question D6e:

What is (NAME's) race?

Rationale:

To describe each resident's race identification. Item will allow assessment of possible differential participation or response rates.

Question D6f:

Is (NAME) of Hispanic or Spanish origin?

Rationale:

To describe each resident's ethnic identification. Item will allow assessment of possible differential participation or response rates.

Clarification:

Is (NAME) of Hispanic or Spanish origin of any race.

Question D6g:

How much school has (NAME) completed?

Rationale:

To describe each resident's education. Item will allow assessment of possible differential participation or response rates.

Question D6h-i:

- h) **Does (NAME) smoke tobacco products?**
i) **If so, do they smoke inside?**

Rationale:

Cigarette smoke is an important pollution source, both actively and passively. The second part of the question can be used to determine the potential for the presence of Environmental Tobacco Smoke in the housing unit and the likely sources of that smoke. Item will allow assessment of possible differential participation or response rates. Also, the number of smokers can be used as a measure of ETS intensity or to define potential source-related domains (metals, particulate, and VOCs).

Question D6j-n:

- j) **How many total hours did (NAME) work or spend time at all jobs or in school in the past week?**
k) **Was most of the time at work spent outside the home?**
l) **How many total hours did (NAME) attend school or day care in the past week?**
m) **Was most of the time in school or daycare spent outside the home?**
n) **How many total hours did (NAME) spend playing outside the home in the past week?**

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Rationale:

Hours worked or time spent in school for people in high exposure situations is an important indicator of overall exposure for that person. In addition, some pollutants may be brought home from work on clothing, shoes, equipment, etc. Alternatively, if exposure occurs at home, time spent away from home will diminish overall exposure. Item will allow assessment of possible differential participation or response rates. Amount of time at home by all household members may be useful as index of air exposure.

Question D6o-p:

- o) Does (NAME) typically work with or around chemicals, at work or at school, used to kill or control insects, rodents, weeds, or other pests?*
- p) Does (NAME) typically work with or around other chemicals, paints, solvents, or cleaners at work or at school?*

Rationale:

Occupational exposure to pesticides or volatile organics may contribute to increased overall exposures. It is intended to determine if people with higher than average potential for exposures to pesticide or volatile organics are more likely than others to be nonrespondents. Hence, this is a check for potential nonresponse bias with regard to exposures to pesticide or volatile organics. People who work around pesticides may, in fact, be less likely than others to respond because of a perceived threat to their vocation. If there are significant differences between respondent and non-respondents on these items, using them in statistical models for non-response adjustment of sampling weights can reduce bias in population estimates regarding characteristics of the distribution of exposures to pesticide or volatile organics. Item will allow assessment of possible differential participation or response rates.

Question D7:

I would like to ask you a few questions about your home? Is your home..... Include all apartments, flats, etc., even if vacant.

Rationale:

To describe the basic housing structure. Item will allow assessment of possible differential participation or response rates. Test whether differential exposures occur for different housing structures.

Question D8:

How many rooms do you have in this house or apartment? Do NOT count bathrooms, porches, balconies, foyers, halls or half-rooms.

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Rationale:

Number of rooms affects ventilation, room density separation, etc., which affect exposure. Number of persons divided by number of rooms may be a useful index for explaining at-home exposures of certain types (e.g., pesticides). Differential response rates may occur for different size homes.

Question D9:

Is this house or apartment owned or rented?
Rationale:
Item is needed to assess whether differential participation rates occur for owners and renters. Item will allow assessment of possible differential participation or response rates.

Question D10:

What is the Roster line number of the selected participant?

Rationale:

This item is needed to record the random selection of a primary respondent for the monitoring phases of the project.

Question D11-12:

Do you have a telephone in this house or apartment? What is your telephone number? If no telephone, is there a number where you can be reached? When is a good time to call you?

Rationale:

This item is needed for quality assurance verification and to allow contact regarding subsequent monitoring appointments. This might also be used as an indicator of socio-economic status, or to help identify the potential bias in surveys that rely entirely on telephone interviews.

BASELINE QUESTIONNAIRE

Question B1:

*Which of these do you consider (yourself/this child)?
(Respondent's race will be circled.)*

Rationale:

To determine whether one's group identification is related to pollution levels, particularly if certain minority groups may be differentially exposed. This is a repeat part of B in the Descriptive Questionnaire, which is based on a second band report and subject to unreliability. Also provides linkage to 1990 Census data on racial/ethnic characteristics and educational level of the study population, relative to the target population. Test if different exposures occur for different races. For some groups, sample sizes may be too small to perform a meaningful statistical analysis for this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B2:

(Are you/Is this child) of Spanish/Hispanic origin?

Rationale:

To obtain further information on different types of Hispanic populations. Also provides linkage to 1990 Census data on racial/ethnic characteristics and educational level of the study population, relative to the target population. Test if differential exposures occur for Spanish origin vs. others. Sample sizes may be too small in this phase of the study to perform statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B3:

What is the highest level of school (you have/this child has) completed?

Rationale:

To determine the highest level of education. Education is generally related to greater awareness of and sensitivity to society-wide problems, and that is possibly true for exposure to these pollutants as well. Educational background is a major indicator of Socio-economic status and is associated with the presence of risk behaviors such as smoking. This is a repeat of B.6 in Descriptive Questionnaire which may be a proxy report provided by another person and subject to unreliability. Also provides linkage to 1990 Census data on racial/ethnic characteristics and educational level of the study population, relative to the target population. Test if differential exposures occur for different education levels. For some

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groups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B4:

(INTERVIEWER WILL CIRCLE SEX OF PARTICIPANT)

Rationale:

To identify each person's gender in order to test whether exposures differ for males and females. Test if differential exposures occur for males and females.

Question B5:

What is (your/his/her) date of birth?

Rationale:

Adult, adolescents, and children may experience different exposure due to differing activity patterns that may be related to age or stage of development. Test if differential exposures occur for different age groups. For some groups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B6:

How tall (are you/is he/she) without shoes?

Rationale:

Information needed for dermal intake models and for bias estimates in dietary sample collection. Height is also a factor in inhalation exposure, for example in locations where soil and dust is resuspended, and indoor air pollutant concentrations often exhibit a gradient with regard to distance from the floor. Used in conjunction with weight to estimate body surface area. May be used to estimate usual energy expenditures, for comparison with measured caloric intake.

Question B7:

How much (do you/does he/she) weigh?

Rationale:

Information needed for dermal intake models, biological marker models, and for bias estimates in dietary sample collection. Used in conjunction with height to estimate body surface area. May be used to estimate usual energy expenditures, for comparison with measured caloric intake. Also used to standardize dose. May be used to estimate usual energy expenditures, for comparison with measured caloric intake.

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Question B8:

- a) (Do you/Does he/she) currently smoke tobacco products or use smokeless tobacco products?
- b) (Have you/Has he/she) ever smoked tobacco products or used smokeless tobacco products?

Rationale:

To determine smoking habits and use of smokeless tobacco. Tobacco smoke is a source of benzene and BAP as well as airborne pollutants. Blood lead levels tended to be higher among children who live in households with smokers (CDC-St. Helena, Kellogg Studies). While the smoking may not directly contribute to the Pb exposure, smoking habits may be indicative of other habits and conditions which may contribute to Pb exposure. Test if differential exposures occur based on smoking status. For some groups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B8c:

Rationale:

Body burden may be quite different for people who recently stopped smoking. This also acts as a gateway question that allow the respondent who has stopped smoking to avoid questions about current smoking and thus reduce the burden. Help refine domains based on Questions B8 and B9. For some groups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B9:

- a) On average, how many cigarettes (do you/does he/she) smoke per day?
- b) On average, how many cigars (do you/does he/she) smoke per day?
- c) On average, how many pipefuls of tobacco (do you/does he/she) smoke per day?
- d) On average, how many times per day (do you/does he/she) use smokeless tobacco products?

Rationale:

To determine smoking habits. Active smoking by the respondent will be a very strong source of many chemicals monitored in biological samples. Tobacco smoke is a source of benzene and BAP as well as airborne pollutants. Blood lead levels tended to be higher among children who live in households with

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smokers (CDC-St. Helena, Kellogg Studies). While the smoking may not directly contribute to the Pb exposure, smoking habits may be indicative of other habits and conditions which may contribute to Pb exposure. Test if differential exposures occur as a result of smoking intensity. For some groups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B10

On average for the past month, how many (hours/minutes) per week did (you/he/she) spend?

Rationale:

Environmental tobacco smoke may be a major source of target chemicals including benzene, BaP, cadmium, and lead expected to be found in many of the samples, including the biological, indoor air, house dust, and the personal and environmental air samples. Question B10 is intended to help define sources of personal ETS exposure. This question will identify nonsmokers who are routinely exposed to ETS. The information collected here will be used to test whether nonsmokers exposed to ETS have higher exposures to relevant target chemicals than nonsmokers who are not routinely exposed and to determine whether exposure to ETS is predictive of levels of personal air exposures and biological levels of target chemicals. If sample sizes are too small to perform a meaningful statistical analysis, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B11a-c:

- a) *During the last month, has anyone, including you, smoked inside your home?*
- b) *On average for the past month, how many days did anyone, including you, smoke inside your home?*
- c) *During the past month, how many people, including visitors, smoked tobacco inside your home?*

Rationale:

Environmental tobacco smoke may be a major source of target chemicals including benzene, BaP, cadmium, and lead expected to be found in many of the samples, including the biological, indoor air, house dust, and the personal and environmental air samples. Questions

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11a and b will identify respondents from homes where smoking occurs and those in nonsmoking homes. It should be possible to test whether differential exposures and environmental concentrations of target chemicals are related to the occurrence of smoking within the home. The information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies. Also may be a factor that can be used to model exposure from air borne pollutants and house dust for selected chemicals.

Question 12a-f:

- a) *How often (do you/does he/she) remove paint?*
- b) *How often (do you/does he/she) solder pipes?*
- c) *How often (do you/does he/she) join pieces of stained glass with solder*
- d) *How often (do you/does he/she) paint picture or jewelry?*
- e) *How often (do you/does he/she) mold lead into fishing sinkers, etc?*
- f) *How often (do you/does he/she) perform electronic repairs using solder?*

Rationale:

To determine potential sources of lead exposure. Carrying out these activities in the home not only contributes to personal exposure, but may increase lead levels in the home. Characterization of hobbies that contribute to individual and household exposure to lead. (St. Helena study found modest elevation of blood levels in children in households where hobbies using lead were carried out.) To determine whether the respondent performed activities that may produce elevated blood levels. The one-month recall period corresponds approximately to the half life of lead in the blood. The results will be used to test if differential exposures occur as a result of activities (may require grouping for infrequent activities). If sample sizes are too small to perform a meaningful statistical analysis, the information collected here be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B13a-f:

- a) *During the growing season, how often (do you/does he/she) eat fresh fruits or vegetables grown at your home?*
- b) *During the growing season, how often (do you/*

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does he/she) eat fresh fruits or vegetables grown in a friend, neighbor, or relative's garden or farm?

- c) *During the growing season, how often (do you/does he/she) eat fresh fruits or vegetables purchased from a local market or stand?*
- d) *How often (do you/does he/she) eat foods canned or preserved in your home or someone else's home?*
- e) *How often (do you/does he/she) eat other foods, such as eggs, milk, or meat, produced at your home or farm or a friend, neighbor, or relative's home or farm?*

Rationale:

Foods obtained outside of regulated and monitored retail sources may contain higher (or different) levels of pesticide and metal contaminants. Test if differential exposures occur as a result of the frequency of consumption, and for different segments of the population (local food consumers vs. non-local food consumers, rural vs. urban, farm family vs. non-arm family). This might change the relationship between dietary exposure measurements and estimates based on existing food contamination databases. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B14a-b:

- a) *How often (do you/does he/she) eat fish caught by you or by a friend, relative, or neighbor?*
- b) *Where were these fish caught?*

Rationale:

To identify a major source of dietary contamination. Seafood and freshwater fish have been found to be contaminated with mercury, PCB's and other pollutants. The types of pollutant found in the seafood will depend upon whether the seafood is a fresh or saltwater dweller and on its feeding habits. A crude estimate of exposure can be made by asking about the total amount of seafood eaten and whether it was purchased or caught, independent of the type of seafood. Purchased seafood is monitored for contamination, while caught seafood is not. Fish and shellfish consumption may not be equal in all segments of the population. Test if differential exposures occur as a result of frequency of activity, and in different segments of the population. For some

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groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B15:

How often do you eat game animals or game birds?

Rationale:

Foods obtained outside of regulated and monitored retail sources may contain higher (or different) levels of pesticide and metal contaminants. Test if differential exposures occur as a result of the frequency of consumption, and for different segments of the population local food consumers vs. non-local food consumers, rural vs. urban, farm family vs. non-farm family). This might change the relationship between dietary exposure measurements and estimates based on existing food contamination databases. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B16a-c:

- a) *How often (do/does) (you/he/she) eat foods grilled, barbequed, or flame broiled?*
- b) *How often (do/does) (you/he/she) eat foods that have been smoked?*
- c) *How often (do/does) (you/he/she) eat foods that have been charred or blackened by burning?*

Rationale

Foods cooked on open flames or using high heat may be a source of certain target pollutants such as PAHs. Test if differential exposures occur as a result of the frequency of consumption, and for different segments of the population. This might change the relationship between dietary exposure measurements and estimates based on existing food contamination databases. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

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Question B17a-d:

- a) How often (do you/does he/she) eat broccoli, cauliflower, or Brussels sprouts?
- b) How often (do you/does he/she) eat cabbage, cole slaw, or sauerkraut?
- c) How often (do you/does he/she) eat mustard greens, collards, or Swiss chard?
- d) How often (do you/does he/she) eat turnips or rutabages?

Question B18:

How often (do you/does he/she) eat grapefruit or drink grapefruit juice?

Rationale:

Evidence suggests that these types of foods have the potential to inhibit the formation of PAH induced DNA adducts. The level of adduct formation will be analyzed in some of the biological samples. Test if differential levels of DNA-adduct formation occur as a result of varying consumption levels in different segments of the population. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B19:

How often (do you/does he/she) drink alcoholic beverages?

Rationale:

The consumption of alcohol has many metabolic effects which can influence the metabolism and elimination of many of the target pollutants. Test for differences in biomarker measurements that may occur as a result of the frequency of consumption, and for different segments of the population. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B20:

About how often (do you/does this child) eat food you or your family purchased in Mexico?

Rationale:

Many people travel to Mexico and bring back legally importable food that is not subject to U.S. laws concerning pesticides. These foods may contain greater amounts of pesticide and some pesticides banned under U.S. law. Consumption of this food may be associated with the high end of pesticide

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distribution in food, blood and urine. Test if differential exposures occur as a result of frequency of activities, and in different segments of the population. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B21:

*In the past 6 months, have (you/this child) often:
(participate in any of the following activities)?*

Rationale:

This question deals with activities that could subject the respondent to ingesting certain contaminants. Such activities are as follows: 1) eating food with one's fingers: Hand-to-mouth activities have been cited as an important vehicle for ingestion of lead and other dustborne contaminants; 2) putting one's mouth on furniture or on the window sill: Mouthing of objects is another means of ingesting dustborne pollutants such as lead. Mouthing window sills in older houses will allow ingestion of paint chips; 3) putting paint chips in one's mouth: Paint chips in older homes may contain pica. This form of pica has been associated with lead poisoning. In order to determine the likelihood of lead exposure, this question is used in conjunction with Question D.2 age of home; 4) eating food that has been dropped on the floor or ground: Dust and dirtborne contaminants will be ingested if food is eaten after it has been on the floor. Young children, and those not trained to avoid picking up food from the floor have increased potential for lead exposure from this habit. Test if differential exposures occur as a result of such activities. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B22 and B24:

(Do you/does he/she) work full or part time outside of the home?

(Do you/does he/she) have a second job?

Rationale:

These gateway questions direct subjects to the appropriate occupational questions and reduces subject burden. This question will also determine if the respondent is engaged in a regular occupation away from the home which would affect the duration of

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possible exposures in and away from the home. Test if differential exposures occur for workers outside home vs. others. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B23a-n and B25a-n:

- a) On average for the past month, how many hours per week did (you/he/she) work at a primary/second job?
- b) What kind of business or industry is this?
- c) What is your job title?
- d) What activities do (you/he/she) perform as part of (your/his/her) duties at that job?
- e) (Do you/does he/she) regularly wear protective clothing while at (your/his/her) (primary/other) job?
- f) Which type of protective clothing (do you/does he/she) regularly wear while at (your/his/her) (primary/other) job?
- g) (Do you/Does he/she) regularly come into contact with dust while at (your/his/her) (primary/other) job?
- h) Which type of dust (do you/does he/she) regularly come into contact with dust while at (your/his/her) (primary/other) job?
- i) (Do you/Does he/she) regularly come into contact with fumes while at (your/his/her) (primary/other) job? (Clarification: Mention gasoline or feul odors as a possible fume.)
- j) Which type of fumes (do you/does he/she) regularly come into contact with dust while at (your/his/her) (primary/other) job?
- k) (Do you/Does he/she) regularly come into contact with chemicals used to kill pests while at (your/his/her) (primary/other) job? (Clarification: Be sure to mention Off, Raid Black Flag, etc.)
- l) Which type of chemicals (do you/does he/she)

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regularly come into contact with while at (your/his/her) (primary/other) job?

- m) *(Do you/Does he/she) regularly come into contact with other chemicals while at (your/his/her) (primary/other) job?*
- n) *Which type of other chemicals (do you/does he/she) regularly come into contact with dust while at (your/his/her) (primary/other) job?*

Rationale:

This is a measure of source identity and intensity for work related exposures and potential decreased exposure for home sources.

Many people have a second job, two part-time jobs or work while enrolled in part or full-time education. In such a case, there may be no exposure at the primary job, but potential for occupational exposures associated with the secondary job. Under such a scenario, information about the second job is equally important. Since a lead in question is provided for both the primary and secondary jobs, the burden only applies to appropriate subject. Test if differential exposures occur for certain types of occupations.

Item a provides a consistency check with the daily time-location diary reporting, and of the need to collect daily information on time-location patterns for routine types of activities (going to work or school). The time spent outside of the home is likely to modify the relationship between indoor and outdoor area and personal exposure monitors.

Items b, c, and d form the basis for applying standard occupational codes and are based on NCHS formats. The information on occupational exposures is needed to help interpret body burden measurements relative to exposure and residential monitoring.

Items e-n will be used to test if differential exposures occur for workers outside home who work in potentially high exposure environments. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions 26a-b:

- a) *(Do you/ does he/she) attend classes as a student at any location away from home?*

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- b) *On average for the past month, how many hours per week did (you/he/she) attend classes as a student?*

Rationale:

This question will help to determine if the respondent is spending large amounts of time away from the home which would affect the duration of possible exposures in and away from the home. It will also provide information on the potential for exposure to contaminants at schools. Exposure to home related sources may be lower for students that spend a large portion of the day at school. These may provide ranges for time-location diary consistency checks. Used in conjunction with questions 22-25 to test if differential exposures occur for individual who spend large amounts of time outside home vs. others. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B27a-b:

FOR CHILDREN LESS THAN 6 YEARS OF AGE:

- a) *How many hours per week does (he/she) routinely spend away from home, for example, in daycare or in preschool?*
- b) *Where does (he/she) spend time away from home?*

Rationale:

Children may have higher or lower exposure to contaminants at schools and daycare. Exposure to home related sources may be lower for children that spend a large portion of the day playing away from home. These may provide ranges for time-location diary consistency checks. Item may be useful for later phases of Study. Sample sizes will be inadequate for current phase. This may help to explain cases with high exposure or body burden measurements that have relatively low residential media concentrations.

Question B28:

What methods of transportation did (you/he/she) usually use to go to work, school, or daycare in the past month?

Rationale:

To determine the method of transportation used most in the past month. Motor vehicle exhaust is a source of exposure to several pollutants, including benzene (and other VOC's) and PAHs. Time spent in transit may be an important factor in explaining exposure and biomonitoring measurements for these pollutants. Test

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if differential exposures occur as a result of large times in transit. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B29:

Overall, how would you describe (your/his/her) current health?

Rationale:

To determine factors that may limit activity or that could be exacerbated by exposure to pollutants. Test for differences in exposure by current health status. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B30a-g:

(Have you/Has he/she) ever had any of the following:

Rationale:

Diseases that subjects have will influence their uptake retention and concentration of specific contaminants in two ways. First, the disease itself may alter the body's balance. Second, medication prescribed to control the disease may affect exposure.

First the subject reports the presence of a disease. Many subjects self-diagnose. It is important to determine what diseases have been professionally diagnosed and whether the disease has resolved or is ongoing. Ongoing disease has a greater potential to be medicated and a greater potential for long term exposure variability. The number of years the disease has been experienced will also affect exposure.

Diuretics are frequently employed in the treatment of Arthritis, heart disease, stroke and diabetes. Antihistamines used to treat allergies act as diuretics. Metals and pesticides consumed with food will have a greater probability of being excreted.

Bone loss (osteoporosis) is frequently associated with Arthritis, Neuromuscular disease, permanent disabilities, and asthma. Calcium supplements taken to counteract the bone loss are very high in Mn and other trace metals. Bone loss also occurs in

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association with metal exposure and has an occupational exposure component.

Other lung diseases may be caused by occupational exposure to metals. Further impeded lung flow may restrict inhalation of contaminants.

Diseases affecting the blood, stomach and bowel will influence metal absorption. Diseases affecting the liver and kidney will influence the body's ability to clear metals and pesticides.

Each of these diseases or conditions affects uptake, retention and concentration of specific contaminants. The presence of these diseases may explain biomarker concentrations or be associated with the distribution function of the measured contaminants. Without knowing underlying conditions, an elevated reading may be associated with exposure instead of disease. Test for differences in exposure-body burden relationship by current health status. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Note: Questions B31 through B53 should only be completed on one baseline Qx for the entire household. These questions relate to housing characteristics and an adult member of the household (e.g. Head of household), should complete these questions. It is not necessary for every member of the household to complete questions B31 through B53 as long as the responses provided to these questions by a respondent capable of providing informed and accurate data has been collected on at least one baseline questionnaire per household.

Question B31:

Is this property actively used as a farm or ranch?

Rationale:

To determine the likely amount of agricultural activity on the land on which the residence sits. Agricultural activity is associated with pesticides and other pollutants of concern. Test if differential exposures occur for farms/ranches vs. other. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B32:

About when was this building first built?

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Rationale:

To determine the age of the buildings in which the population lives; this, in turn, may determine the out-gassing strength from building materials. CLEAR community (Jersey City) was one of the U.S. cities identified by EPA as having unacceptable lead levels in water. The age of the home is indicative of the likelihood of lead solder in water pipes, and lead in the paint. Form age categories. Test if differential exposures occur as a result of age of home. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B33:

When did (you/he/she) move into this house or apartment?

Rational:

To determine how many years the occupants have lived in this building (and, thus, how long they have been exposed to pollutants in that residence). Use as possible predictor in exposure models. Also a descriptor of population mobility (used in assessment of long-term exposures).

Question B34:

In the past six months, have any of the following been performed in this home?

Rationale:

To determine whether any construction has taken place in the home. Home construction is a major source of dust. It takes anywhere from 3-6 months in a home that is cleaned regularly for the dust from construction to be cleaned up. This question in conjunction with information about the age of the home will provide information about potential lead exposure in the home. The followup questions identify when the renovations were carried out and how extensive they were. New materials may also out-gas VOCs. Also have persistence in biological media that may reduce the relationship of current exposures and media concentrations to body burden measurements. Use to refine housing categories and use as indicated. Test if differential exposures occur as a result of recent construction activity in the home. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase

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Question B35a:

Does this (house/apartment) have running water?

Rationale:

Water is an important source of exposure via both the ingestion and dermal contact pathways. The question acts as a gateway directing the respondent to the appropriate question, reducing burden. Test if differential exposures occur as a result of source of tap water. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this Phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B35b:

What is the source of the running water in your house?

Rationale:

Water quality is related to the disinfection process employed, if any. Municipal supplies predominately use chlorine for this process leading to the production of trihalomethanes, of which chloroform is a pollutant of interest in this Pilot Study. Bottled water has been shown in some cases to contain trace levels of benzene. Ground water has been shown to become contaminated by underground storage tanks containing gasoline which contains several aromatics of interest. Test if differential exposures occur as a result of the source of tap water. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B35c:

Which water source is used most often for cooking and drinking?

Rationale:

Water quality may lead to contamination of food cooked in water from certain source waters. Examine the relationships between contaminated source water used for cooking and levels of pollutants in food. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B35d:

Which water source is used most often for drinking?

Rationale:

Drinking water is a potential source of exposure for several of the target pollutants through the ingestion pathway. Provides input information for use in ingestion exposure models. Test relationships between pollutant levels found in drinking water samples and the sources of water used for drinking. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B35e:

Do you use (CHOICES) to treat your water at home?

Rationale:

Treatment of water at the home may remove pollutants in the supply to the house, thus lowering the exposure level to a variety of pollutants. Examine the relationship between water treated at the home and biological marker levels. Needed to relate the concentrations in household water to that of the general water supply, for comparisons of assessments based on existing data and that collected by NHEXAS. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B36a-c:

- a) ***Is there a garage attached to this house or apartment?***
- b) ***Where is the attached garage?***
- c) ***Is there a doorway leading directly from the garage into the living quarters?***

Rationale:

Activities, vehicles, and products stored in attached garages may be sources of VOC, PAH, metal, and particle exposure for residents in the home. Test if differential air concentrations and exposure occur for homes with/without. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of

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Question B36d:

Are automobiles, vans, trucks or other motor vehicles usually parked in this attached garage?

Rationale:

To determine household proximity to motor vehicles. Attached garages have been determined to increase household exposure to motor vehicle pollutants. To determine likely sources of exposure to vehicle exhaust pollutants (PAHs, VOCs, other combustion products), and as lead-in to D.12. Test if differential air concentrations and exposures occur for homes with/without an attached garage. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B37:

Are any gas powered devices stored in any room, basement, or attached garage in this house or apartment?

Rationale:

This is a continuation of the previous questions on automobile exposure. As with the previous two questions, these questions provide information about two of the target pollutants - benzene and BaP. It allows for a better assessment of exposure since the responses provide information about frequency and duration of use of attached or underneath garages. To determine likely sources, characteristics, and amounts of exposure to vehicle exhaust pollutants (PAHs, VOCs, other combustion products). Test if differential air concentrations and exposures occur for homes with/without attached garage.

Questions B38a-c:

- a) ***Is air conditioning (refrigeration) used to cool this house or apartment?***
- b) ***What type of air conditioning units do you use?***
- c) ***During what months do you usually start and stop using air conditioning to cool this house or apartment?***

Rationale:

Determination of the type, duration and frequency of use of ventilation systems is important when air sampling and dust collection is carried out. Air conditioner use may reduce exchange rates with outdoor air. Test if differential air concentrations and exposure occur for homes with/without air conditioners. For some groups, sample sizes may be too

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small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B39a-f:

ARIZONA ONLY.

- a) *Is an evaporative (swamp) cooler used to cool this house or apartment?*
- b) *What types of evaporative cooler units do you use?*
- c) *How often are pads changed?*
- d) *What types of pads are currently used?*
- e) *How often is the water drained and the cooler cleaned?*
- f) *How often is water treatment added to the cooler?*

Rationale:

Determination of the type, duration and frequency of use of ventilation systems is important when air sampling and dust collection is carried out. Evaporative coolers increase exchange rates with outdoor air, but offer some filtration of incoming air through dampened pads. Further, the dust in the incoming air is deposited inside the cooler. In a poorly maintained system, airborne contaminants can be blown into the home in a dust concentrate. This dust is incorporated into the household dust. Information will be used in calculation/estimation/adjustment of indoor air concentration used in inhalation exposure models and to assist in the interpretation of indoor air measurements. Question a may also be used to test if differential air concentrations and exposure occur for homes with/without evaporative coolers. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B40:

Which fuels are used for heating this house or apartment?

Rationale:

To determine the main form of energy used to heat the living quarters. Combustion products can include aerosols, benzene and BaP. Some fuels burn cleaner than others and are less likely to be local pollutant

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sources. Also, different air concentrations occur for different types of fuels. Test if different personal air exposures occur for different types of fuels. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B41:

Does this house or apartment have a central heating system with ducts that blow air into most rooms?

Rationale:

Central air systems distribute pollutants throughout a home and affect aerosol suspension and distribution. Test if different air concentrations occur for homes with/without central heating systems. For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies. May change the relationship of personal exposure measurements to area samples (media concentrations; Hypothesis 4B).

Question B42:

During what month do you usually start and stop using heating devices?

Rationale:

To determine the duration and period of home heating to estimate total time exposure to heating source pollution. This information can be used to determine whether the home is heated during the interview and sampling period. Refine categories for analyses related to home heating. May be helpful in extending the exposure assessment to time periods not directly monitored for the participant.

Question B43 a-c:

- a) *During the months identified in the last question, do you use portable kerosene heaters in this house or apartment?*
- b) *How many kerosene heaters did you use last year?*
- c) *How often do you use your kerosene heaters during the months identified in the last question?*

Rationale:

To determine the use, and frequency of use of kerosene heaters. Kerosene combustion is a source of BaP, aerosols, and possibly benzene. Kerosene heaters are a very important source of combustion pollutants.

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Space heaters must actually be used to be counted in parts (a) and (c). Test if differential exposures occur as a result of use. The presence and history of operation for these sources is also important in evaluating the relationship between surface dust loadings ($\mu\text{g}/\text{cm}^2$) and the concentration of chemicals in dust ($\mu\text{g}/\text{g}$). For some groups, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B44a-c:

- a) *During the heating season, is a portable or unvented gas heater used in this house or apartment?*
- b) *How many gas heaters?*
- c) *How often is a portable or nonvented gas heater used?*

Rationale:

To determine the use and frequency of use of gas heaters. Test if differential exposures occur as a result of use. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B45a-d:

- a) *During the heating season, is a wood-burning or coal-burning stove used in this house or apartment?*
- b) *How many wood or coal-burning stoves?*
- c) *How often is a wood-burning or coal-burning stove used during the heating season?*
- d) *What is usually burned in the stove?*

Rationale:

To determine the use and frequency of use of wood-burning or coal-burning stoves. Both are important source of particles (air and surface) and BaP. Test if differential exposures occur as a result of use. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies. The presence and history of operation for

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these sources is also important in evaluating the relationship between surface dust loadings ($\mu\text{g}/\text{cm}^2$) and the concentration of chemicals in dust ($\mu\text{g}/\text{g}$).

Questions B46a-d:

- a) During the heating season, is a fireplace used in this house or apartment?
- b) How many fireplaces?
- c) How often is a fireplace used during the heating season?
- d) What is burned in the fireplace?

Rationale:

To identify residences that have at least one fireplace and how many. To determine the use, and frequency of use of fireplaces. Fireplaces can be inefficient sources of heat, and potential sources of in-house and neighborhood pollutants including BaP. Test if differential exposures occur as a result of use. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies. The presence and history of operation for these sources is also important in evaluating the relationship between surface dust loadings ($\mu\text{g}/\text{cm}^2$) and the concentration of chemicals in dust ($\mu\text{g}/\text{g}$).

Question B47a-i:

- a) In the past 6 months, were any chemicals for the control of termites, insects, rodents, or other pests used inside this house or apartment?
- b) In the past 6 months, which rooms in your home were treated with products to control termites, insects, rodents, or other pests?
- c) Which areas within the room(s) were treated?
- d) In the past 6 months, how many times....?
- e) In what month were they last used inside your home or apartment?
- f) What is (are) the name(s) of the product(s) last used in your house apartment?
- g) The last time the product(s) was used inside the home or apartment, how was it prepared for application?
- h) The last time the product(s) was used inside the home or apartment, who mixed the product?

i) Where were they mixed?

Rationale:

Chlorpyrofos is of concern because it is a broad-spectrum pesticide, is probably the most frequent one used, and thus, is probably present in high concentrations. As an organophosphate pesticide, it is a cholinesterase (ChE) inhibitor and therefore has potential for harm, specifically neurological and hematological; exposure occurs through usage, contact with surfaces (including soil) or water near applications (or from further contamination); it can be ingested, absorbed, and/or inhaled. Test if differential exposures occur as a result of use or usage frequency, and duration since last use (based on decay rate in environmental and biological media). In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question 48a-g:

- a) In the past 6 months, were any chemicals for the control of termites, insects, rodents, or other pests used outside this house or apartment?
- b) In the past 6 months, how many times....?
- c) In what month were they last used inside your home or apartment?
- d) What is (are) the name(s) of the product(s) last used in your house apartment?
- e) The last time the product(s) was used inside the home or apartment, how was it prepared for application?
- f) The last time the product(s) was used inside the home or apartment, who mixed the product?
- g) Where were they mixed?

Rationale:

Pesticides used outside the home are potential sources of exposure both through direct contact while outside and through indirect contact via processes such as track in and air transport of contaminated dust. Test if differential exposures occur as a result of use or usage frequency, and duration since last use (based on decay rate in environmental media). In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible

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cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B49 a-g:

- a) *In the past 6 months, have you had any regular lawn treatments?*
- b) *Who usually applies these treatments?*
- c) *Were products wet or dry?*
- d) *In the past 6 months, how many lawn treatment(s) contained only fertilizer?*
- e) *In the past 6 months, how many lawn treatment(s) contained fertilizer and weed control?*
- f) *In the past 6 months, how many lawn treatment(s) contained fertilizer and pest control?*
- g) *In what month was the last treatment applied?*

Rationale:

Chemicals used in home lawn treatment pose a potential source of exposure to certain target chemicals. There is concern over the routine use of pesticides (i.e., insecticides and herbicides) and potential risks to the population (especially young children) through direct contact with treated surfaces and through track-in to the home. Since these treatments vary seasonally, it is important that the number and types of treatments be determined. It is also important to determine whether the treatments are commercial application or applied by the homeowner. Test if differential exposures occur as a result of use or usage frequency. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Clarification:

In certain portions of the state of Arizona, use of the term "lawn" may mislead the respondent to ignore this suite of questions. The term "lawn" may be replaced with "yard" as appropriate.

Question B50:

During the past 6 months, have mothballs been used in this house or apartment?

Rationale:

These are sources for p-dichlorobenzene exposure. Test if differential exposures occur as a result of p-dichlorobenzene use. In some cases,

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sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question B51:

During the past 6 months, have room deodorizers been used in this house or apartment?

Rationale:

These are sources for volatile organic compound(VOC) exposure. Test if differential exposures occur as a result of use. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions B52 a-e:

- a) *Do you have house pets such as dogs, cats, gerbils, hamsters, rabbits, guinea pigs, birds?*
- b) *How many are kept indoors most of the time?*
- c) *How many are kept outdoors most of the time?*
- d) *How many are kept indoors and outdoors?*
- e) *Were any chemicals used on the pets to control fleas and ticks?*

Rationale:

Pets in the home may lead to exposure to a variety of pollutants; aerosols from the animals or tracked-in from outdoors; metals tracked-in, and pesticides applied to the animals and inside or around the home. Test if differential exposure occurs for homes with/without pets and those who use chemicals to control pests and those who do not. This may also be used in conjunction with question 48 to evaluate the contribution made by the indirect pathway via track-in to pesticide exposures. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

TIME DIARY AND ACTIVITY QUESTIONNAIRE

Daily Time Expenditure Blocks:

Rationale: Since exposure is the product of the time (t) a subject

spends in contact with a pollutant and the concentration (c), it is essential to measure both. The fastest, most inexpensive way to determine time expenditure is to ask the subject. The time/activity diary accurately reports the amount of time each subject spends in areas with measured amounts of target metal, pesticide, PAH, or VOC pollutants and those actions that enhance exposure. Pollutant concentrations are measured from personal exposure samples, samples collected in the home, samples collected regionally and data that can be inferred from questions in the Baseline and Followup questionnaires.

This diary was developed to collect the minimum required level of detail in a format that would aid the respondent in thinking about their day and providing accurate recall of the day's events.

Time locations: Indoor Locations, Outdoor Locations,
Transit

Indoors

1. We have direct measurements of contaminants at home.
2. Key classes of contaminants at home and at work are identified in the Baseline Questionnaire.
3. We know nothing about other indoor environments; yet this time serves as a logical check to account for a full 24-hour day.

Outdoors

1. We have outdoor measurements of metals, VOCs, and pesticides at a subset of the homes. We can obtain regional records from pollution control districts of airborne particulate and regional transportation indicators (proxy for VOC).
2. Key classes of contaminants at work are identified in the Baseline Questionnaire. Further, we can obtain regional records from pollution control districts of airborne particulate and regional transportation indicators (proxy for VOC).
3. For other outdoor environments, we can obtain regional records from pollution control districts of airborne particulate and regional transportation indicators (proxy for VOC).

Transit

1. We have no direct measure of contaminant levels within any individual vehicle. We can obtain regional records from pollution control districts and regional transportation indicators (proxy for VOC) at key intersections.

Cumulatively, these categories account for all 24 hours of the subject's day. Measurements of some of the key pollutants are available for all but one of the locations.

The summary time locations are very important. The specific time of day is less important. The best way to view the specific hours is as a memory aid. Marking the hours spent in a given location facilitates an accurate

report of the summary hours. Further, if the individual hours are marked, errors in the summary hours may be resolvable jointly by the subject and field technician at the end of the sampling week. Exposures and biomarkers can be compared for subgroups defined by time spent indoors, outdoors, at home, etc. For some subgroups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies. In addition, exposure models can utilize information on time spent in various microenvironments to predict individuals' exposures.

Activity Reports:

Rationale:

Some actions or behaviors increase the risk of exposure to high concentrations of a target pollutant. We have asked for the minimum resolution of data necessary to evaluate concentrations of the target pollutant in the blood or urine of the subject. Items A1 through A29 (below) will have multiple responses (one per day). The responses to an item, taken together (and perhaps grouped with similar items), can be used to define population subgroups that can be compared with respect to participants' exposures or that can be used as, or converted to, predictor variables (e.g., number of days with a reported activity). For some subgroups, sample sizes may be too small to perform a meaningful statistical analysis. For those cases, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Activities You or Your Child Did or Were Around

Question A1 :

Pumped gas today?

Rationale:

Pumping gasoline may contribute to both dermal and inhalation exposure to benzene and other gasoline components.

Clarification:

Did (you/your child) utilize a self-service gas station today.

Question A2 :

Had gasoline in contact with the skin today?

Rationale:

Dermal exposure to gasoline for some individuals may be an important contribution to total exposure to benzene and other gasoline components.

Question A3 :

Spent time in an enclosed garage with a parked car today?

Rationale:

Time spent in an enclosed garage can subject an individual to benzene fumes.

Question A4 :

Had soil, dirt, or dust in contact with the skin at home today?

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- Rationale: To assess the potential contribution of soil contact at home to total exposure to compounds such as Ar, Pb, and chlorpyrifos.
- Clarification: An alternative wording of the question is whether you or your child had soil or dirt from your yard in contact with your skin today?
- Question A5 : *Had grass or foliage in contact with the skin at home today?*
- Rationale: To assess the potential contribution of dermal exposure at home to total exposure to compounds such as Ar, Pb, and chlorpyrifos.
- Clarification: Did you or your child's skin come in contact with grass or leaves in your yard today?
- Question A6: *Did (you/your child) clean a fireplace or wood stove today?*
- Question A7: *Did (you/your child) start or manage a fire in a fireplace or wood stove today?*
- Rationale: Fireplaces and wood stoves are sources of combustion products. Unless the chimney draw is very clean, a fire burning in a fireplace will contribute to airborne pollutants in a home. In addition, the individual who manages the fire and cleans the fireplace has additional opportunities for dermal and inhalation exposure to these pollutants.
- Clarification: Managing a fire is the same as tending a fire.
- Question A8 : *Did (you/your child) use an outdoor grill or burn wood, leaves, or trash today?*
- Rationale: Personal exposure to combustion products will result from actively using a grill or burning wood or leaves.
- Question A9: *Were any tobacco products smoked in the home today?*
- Rationale: To determine exposure to environmental tobacco smoke -- a source of BaP, benzene, and particulates. Environmental tobacco smoke within the home will contribute to indoor levels of BaP, benzene, and particulates, as well as to the individual's exposure to ETS while he/she is in the home.
- Question A10 : *How many glasses or cups of water did (you/your child) drink today?*
- Rationale: The frequency with which water is drunk may be an easier measure of water ingestion for participants to answer than the number of 8 oz. glasses. Water consumption estimates the exposure to Ar, Pb, benzene and other contaminants in water supplies.
- Clarification: Water used to make juices, teas, coffee, or other prepared drinks should not be included.
- Question A11 : *How many cigarettes did (you/your child) smoke today?*
- Rationale: To quantify the source intensity of directly inhaled

tobacco smoke. Tobacco smoke is a source of benzene, cadmium, BaP, and aerosols.

Question A12 :

How many cigars or pipefuls did (you/your child) smoke today?

Rationale:

To quantify cigar and pipe source intensity. Smoking is a source of BaP, benzene and other airborne pollutants. As the question is currently structured, it will identify personal exposure, rather than environmental contamination. Identification of the location of smoking is necessary to characterize environmental contamination.

Clarification:

Pipefuls of tobacco today.

Question A13 :

How many times did (you/your child) use smokeless tobacco today?

Rationale:

To quantify smokeless tobacco usage. Smokeless tobacco use may influence the level of metabolites measured in the biomonitoring samples.

Clarification:

Smokeless tobacco is equivalent to chewing tobacco.

Question A14 :

How many times did (you/your child) wash (your/his/her) hands today?

Rationale:

To quantify an activity that may affect dermal and ingestion exposures to metals and pesticides. Hand washing is a means of removing dust borne contaminants. Individuals who infrequently wash hands may introduce contamination into the home, or themselves through dermal absorption or ingestion. Hand washing frequency may also be an indicator of other conditions in the home.

Question A15 :

Number of minutes traveled on roadways or highways today?

Rationale:

Riding in motor vehicles will contribute to inhalation exposures to benzene, other VOCs, PAHs, and aerosols.

Clarification:

This includes travel on streets.

Question A16:

Number of minutes spent indoors with someone who is smoking today?

Rationale:

To quantify duration of exposure to ETS in indoor environments. Smoking is a source of BaP, benzene and other airborne pollutants. As the question is currently structured, it will identify personal exposure, rather than environmental contamination.

Question A17:

Number of minutes spent in a vehicle with someone who was smoking today?

Rationale:

To quantify duration of exposure to ETS inside vehicles. Smoking is a source of BaP, benzene and other airborne pollutants. As the question is currently structured, it will identify personal exposure, rather than environmental contamination.

Question A18 :

Number of minutes spent showering today?

Rationale:

To quantify the source intensity of showering as a component of total exposure of Pb and VOCs as a result of inhalation, dermal absorption, and ingestion.

Question A19 :

Number of minutes spent bathing today?

Rationale:

To quantify the source intensity of bathing as a component of total exposure of Pb and VOCs as a result of inhalation, dermal absorption, and ingestion.

Question A20 :

Number of minutes spent swimming in indoor or outdoor pools today?

Rationale:

To quantify the source intensity of swimming as a component of total exposure to VOCs as a result of inhalation, dermal absorption, and ingestion.

Clarification:

This includes time in spas, jacuzzis, whirlpools hot tubs, etc.

Question A21 :

Number of minutes spent (pouring, mixing) pesticides, insecticides, or herbicides today?

Rationale:

Exposure estimations require media level measurements and the time in contact with the contaminated media.

Question A22 :

Number of minutes spent applying pesticides, insecticides, or herbicides today?

Rationale:

Exposure estimations require media level measurements and the time in contact with the contaminated media.

Question A23 :

Number of minutes spent using cleaning supplies (cleaners, waxes, polishes) today?

Rationale:

Use of cleaning supplies may contribute to an individual's exposure to VOCs and to dust borne pollutants.

Question A24 :

Number of minutes spent laying down or sitting on the carpet or rugs at home today?

Rationale:

Carpets may be reservoirs for dust and contaminants. Sitting or lying on the carpet may be routes for dermal, inhalation and ingestion exposure to pollutants such as lead and pesticides.

Question A25 :

Number of hours spent in an enclosed workshop or garage used as a workshop today?

Rationale:

Workshops are a source of various VOCs including benzene. Other pollutants including PAHs and metals may be present in the workshop depending on the activities carried out there.

Question A26 :

Number of hours doors and windows at your house were left open for ventilation today?

Rationale:

Open windows and doors aid in ventilation and can change the concentrations of indoor pollutants by removing pollutants generated indoors and increasing the penetration into the home by outdoor pollutants.

Question A27 :

Number of hours spent performing quiet activities; like sleeping, resting, reclining, watching TV, and other seated activities today?

Rationale:

This question reflects inactivity and low ventilation rate. The information will also be used to estimate energy expenditures for assessing potential dietary sample collection bias.

Question A28 :

Number of hours spent performing moderate exercise like walking, gardening, working while on your feet, or playing softball or golf today?

Rationale:

This question is used to quantify the amount of time spent at an intermediate level of activity and ventilation rate. Also used to assess potential dietary sample collection bias.

Question A29 :

Number of hours spent performing vigorous exercise like digging or other heavy manual labor, running, bicycling, aerobic dancing, playing basketball or soccer today?

Rationale:

This question is used to quantify the amount of time spent at an elevated level of activity and ventilation rate. Also used to assess potential dietary sample collection bias.

24-HOUR FOOD DIARY

Data Collection:

- a. *Self-administered list of food and beverage items consumed on the day of collection.*
- b. *Diary will be used for one consecutive day by each participant.*
- c. *Diary will be reviewed by field staff or interviewer, with followup probes on cooking and non-retail source of food items. Collected portion sizes will be measured or estimated.*

Rationale:

- a. The diary will provide source information for dietary intake data analysis.

In conjunction with NHEXAS, FDA will be conducting Total Diet Studies in Arizona and Region 5. The results of the Total Diet Studies will be compared to the results obtained from the NHEXAS duplicate diet studies. The 24-hour food diary results can be compared to the food items in the Total Diet Study to attempt to explain any discrepancies between TDS and NHEXAS duplicate diet results.

Food type and portion size data will be used to perform metal contaminant intake estimates from the FDA Total Diet Study (TDS) data. Items reported in the food diary will be coded to match items reported in TDS.

Concentrations of target chemicals in each food type reported in TDS will be multiplied by reported intakes for each individual and the results summed to provide an estimate of total intake of the target chemical during the time that the duplicate diet sample was collected. These estimates will then be compared to the measured intake. It has been recommended by an expert panel that dietary intakes in NHEXAS Phase II be estimated using extant data; however, it is not now known if such estimates will accurately predict dietary intake at the 50th percentile, or the intake for those persons most highly exposed (i.e. 90th or 95th percentile).

- b. Food type, amount, source, cooking, and location information may be used to examine associations between source parameters and the measured dietary intake.

Intake of metal and pesticide contaminants may be dependent on the types of foods consumed, the amount of foods consumed, the source of the foods, the cooking practice, and the location of food preparation/consumption.

- c. Regional market basket surveys can be designed using the food intake information.

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Diary data, describing the kinds and amounts of individual foods consumed by the study participants (a sample that will be representative of the Regional population), can be used to aid the design of a regional market basket study of contaminant intake. The foods and amounts on the diary will be used to calculate estimated intakes of lead and arsenic (possibly cadmium) from Total Diet Study data. Differences between estimates and measured intakes will be calculated for individuals. Average differences, average percentage differences and correlations between estimated and measured intakes will be computed for groups of individuals.

Clarification:

Please complete the 24-hour food diary for Day 1 only. Days 2 through 4 can be ignored.

FOOD DIARY FOLLOWUP QUESTIONNAIRE

Clarification:

Please complete the Food Diary Followup Questionnaire for Day 1 only. Days 2 through 4 can be ignored.

Question FD1:

Was breakfast eaten?

Rationale:

People may provide less food than expected; it is important to know if they skipped a meal during the day. The information will be used for sample collection and bias assessment. This provides a gateway for the next two questions. This information may also be used to assess general dietary habits of individuals and the study population. Data will be available to examine, as a data quality assessment, associations between low values of collected foods and reported consumption of the meal. The information may be used for outlier evaluation and /or an examination of potential sample collection bias. Individual and group data may be compiled to provide a dietary pattern record.

Question FD2:

Where was (your/his/her) breakfast prepared and eaten?

Rationale:

Foods and beverages may become contaminated after leaving retail suppliers. Contamination may occur in the participant's home as a result of dust contact, water used for cooking, cooking method, etc. This information will allow tests of associations between contaminant levels and location; and with environmental measurements in the home. This information may also be used to assess general dietary habits of individuals and the study population. Data will also be used to examine, as a data quality assessment, associations between low values of collected foods and locations where meals were prepared and eaten. For example, the respondent may choose not to provide a duplicate of a restaurant meal. The information may be used for outlier evaluation and /or an examination of potential sample collection bias. Data will be available to examine associations between preparation and consumption locations and levels in the duplicate diet samples, other environmental media, and biological media. For example, Spearman correlations between measured exposure levels and frequency of in-home meal preparation can be computed. Data may also be compiled to provide a dietary pattern record. If sample sizes are too small to allow a meaningful comparison of subgroups, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question FD3:

How often is (your/his/her) breakfast meal like the one you listed in the diary?

Rationale:

People consume many different kinds of foods at varying frequencies. Information can be obtained even during a one day sampling regimen for usual consumption frequencies for the foods that are collected (and by extension, the measured contaminant intake). This information may also be used to assess general dietary habits; and may

potentially be used to assess alterations (collection bias) in dietary behavior induced by the sample collection. Data will be available to examine, as a data quality assessment, relationships between high or low contaminant values and reported frequencies of meal consumption. The information may be used to identify unusual consumption patterns, outliers, or potential sample collection bias. Individual and group data may be compiled as a dietary pattern record.

Question FD4:

Was lunch eaten?

Rationale:

People may provide less food than expected; it is important to know if they skipped a meal during the day. The information will be used for sample collection and bias assessment. This provides a gateway for the next two questions. This information may also be used to assess general dietary habits of individuals and the study population. Data will be available to examine, as a data quality assessment, associations between low values of collected foods and reported consumption of the meal. The information may be used for outlier evaluation and /or an examination of potential sample collection bias. Individual and group data may be compiled to provide a dietary pattern record.

Question FD5:

Where was (your/his/her) lunch prepared and eaten?

Rationale:

Foods and beverages may become contaminated after leaving retail suppliers. Contamination may occur in the participant's home as a result of dust contact, water used for cooking, cooking method, etc. This information will allow tests of associations between contaminant levels and location; and with environmental measurements in the home. This information may also be used to assess general dietary habits of individuals and the study population. Data will also be used to examine, as a data quality assessment, associations between low values of collected foods and locations where meals were prepared and eaten. For example, the respondent may choose not to provide a duplicate of a restaurant meal. The information may be used for outlier evaluation and /or an examination of potential sample collection bias. Data will be available to examine associations between preparation and consumption locations and levels in the duplicate diet samples, other environmental media, and biological media. For example, Spearman correlations between measured exposure levels and frequency of in-home meal preparation can be computed. Data may also be compiled to provide a dietary pattern record. If sample sizes are too small to allow a meaningful comparison of subgroups, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question FD6:

How often is (your/his/her) lunch meal like the one you

listed in the diary?

Rationale:

People consume many different kinds of foods at varying frequencies. It will not be possible to obtain quantitative measurements of usual dietary intakes over four consecutive days; but some information can be obtained for usual consumption frequencies for the foods that are collected (and by extension, the measured contaminant intake). This information may also be used to assess general dietary habits; and may potentially be used to assess alterations (collection bias) in dietary behavior induced by the sample collection. Data will be available to examine, as a data quality assessment, relationships between high or low contaminant values and reported frequencies of meal consumption. The information may be used to identify unusual consumption patterns, outliers, or potential sample collection bias. Individual and group data may be compiled as a dietary pattern record.

Question FD7:

Was dinner eaten?

Rationale:

People may provide less food than expected; it is important to know if they skipped a meal during the day. The information will be used for sample collection and bias assessment. This provides a gateway for the next two questions. This information may also be used to assess general dietary habits of individuals and the study population. Data will be available to examine, as a data quality assessment, associations between low values of collected foods and reported consumption of the meal. The information may be used for outlier evaluation and /or an examination of potential sample collection bias. Individual and group data may be compiled to provide a dietary pattern record.

Question FD8:

Where was (your/his/her) dinner prepared and eaten?

Rationale:

Foods and beverages may become contaminated after leaving retail suppliers. Contamination may occur in the participant home as a result of dust contact, water used for cooking, cooking method, etc. This information will allow tests of associations between contaminant levels and location; and with environmental measurements in the home. This information may also be used to assess general dietary habits of individuals and the study population. Data will also be used to examine, as a data quality assessment, associations between low values of collected foods and locations where meals were prepared and eaten. For example, the respondent may choose not to provide a duplicate of a restaurant meal. The information may be used for outlier evaluation and /or an examination of potential sample collection bias. Data will be available to examine associations between preparation and consumption locations and levels in the duplicate diet samples, other environmental media, and biological media. For example, Spearman correlations between measured exposure levels and frequency of in-home meal preparation can be computed. Data may also be compiled to provide a dietary pattern record. If sample sizes are too small to

allow a meaningful comparison of subgroups, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question FD9:

How often is (your/his/her) dinner meal like the one you listed in the diary?

Rationale:

People consume many different kinds of foods at varying frequencies. Information can be obtained even during a one day sampling regimen for usual consumption frequencies for the foods that are collected (and by extension, the measured contaminant intake). This information may also be used to assess general dietary habits; and may potentially be used to assess alterations (collection bias) in dietary behavior induced by the sample collection. Data will be available to examine, as a data quality assessment, relationships between high or low contaminant values and reported frequencies of meal consumption. The information may be used to identify unusual consumption patterns, outliers, or potential sample collection bias. Individual and group data may be compiled as a dietary pattern record.

Question FD10:

Please think back, were there any foods or beverages that you could not or did not collect for use?

- a. At Breakfast
- b. At Lunch
- c. At Dinner
- d. For Snacks

Rationale:

Participants are responsible for collecting dietary samples. Participants may be unwilling or unable to collect duplicate portions of all foods. It is important to collect information about foods (identity, source, amount) that were not collected as a data quality indicator. In some cases the information may be used to replace or collect the missing foods. Data will be available to examine, as a data quality assessment, the number, type, and amount of missing foods and the potential bias in contaminant intake measurements. The data can also be used to assess the collection method and to allow for adjustments to the method that improve the completeness of sample collection.

Question FD11:

- a. Did (you/he/she), for any reason, eat more or less food today than usual?

- b. Because of:

Rationale:

Participants may alter their usual dietary pattern because of factors in their own lives or because of the food collection study. It will not be possible to make quantitative assessments of dietary pattern changes in this study, but simple questions can be used to assess major alterations in dietary intake. When evaluating potential biases in sample collection, it is important to know when there are legitimate reasons for collecting more

food or less food than usual. Data will be available to examine, as a data quality assessment, reported changes in the participants' dietary patterns. These data can be used to assess outliers in the amount of food collected. The data may also be compiled for individuals and the study group as part of a dietary pattern record.

Question FD12:

- a. *Did (you/he/she), for any reason, eat different foods today than (your/his/her) usual diet?*
- b. *If yes, was that because:*

Rationale:

Participants may alter their usual dietary pattern because of factors in their own lives or because of the food collection study. It will not be possible to make quantitative assessments of dietary pattern changes in this study, but simple questions can be used to assess major alterations in dietary intake. When evaluating potential biases in sample collection, it is important to know when there are legitimate reasons for collecting different foods than usual. Data will be available to examine, as a data quality assessment, reported changes in the participants' dietary patterns. These data can be used to assess outliers in the amount of food collected. The data may also be compiled for individuals and the study group as part of a dietary pattern record.

TECHNICIAN WALKTHROUGH QUESTIONNAIRE

Question T1:

How many stories (floors) are in this building? (Count only floors with finished rooms for living purposes or full basements.)

Rationale:

To characterize the building by number of stories. The information will be used to classify residences.

Question T2:

Which floor(s) do respondent's live on?

Rationale:

To characterize the housing unit occupied by respondents.

Clarification:

Typical answers would be 1st, 2nd, 3rd, etc. not 1,2,3.

Question T3:

How many rooms (not counting bathrooms or half-rooms) are in this home or apartment?

Rationale:

To characterize the housing unit occupied by respondents. Number of occupants divided by number of rooms may be a useful index for at-home air and dust exposures. Test if differential dust and air concentrations correlate with the index.

Question T4:

Of those rooms, how many are carpeted or have rugs covering most (>50%) of their surfaces?

Rationale:

To characterize the housing unit and provide information on absorptive surfaces. Test if dust and air concentrations (particulates, metals) correlate with number of carpeted rooms.

Question T5:

Using the following statements, how would you rate the overall dust control effort within the residence.

Rationale:

To determine the extent of residential dust control. This factor influences residential particulate matter concentrations, and may be associated with aeroallergen levels and other pollutants through multiple exposure pathways. Test if differential air and dust concentrations correlated with dust rating.

Question T6:

Indicate nearest major intersection.

Rationale:

Relatively inexpensive GPS instruments are now available for exactly locating a residence during the technician visit. The latitude and longitude coordinates provided by the GPS instrument may be used in exposure modeling, determining relations to fixed-site community monitors, and for GIS applications. Can be used to link records from regional pollution control districts and regional transportation planning departments to sample housing units. These data will be treated as confidential.

Question T7a-T7j:

a. ***Surrounding area (residential, recreational, etc.).***

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- b. Distance to street.
- c. Exterior siding material.
- d. Condition of exterior painted surfaces.
- e. Condition of interior painted surfaces.
- f. Material around primary entrance to structure.
- g. Dripline.
- h. Roof type and composition
- i. Yard material.
- j. Types of foundation.

Rationale:

This series of questions is designed to assess and classify the neighborhood of the designated respondent's residence. Local factors may have a strong influence on residential pollutant concentrations.

The purpose of T7 a-j is as follows: Soil samples from the house foundation and the yard will be analyzed for metal and pesticide contamination. In arid regions, dust may accumulate on the roof and walls for several months. The amount of this dust washed to the foundation will depend on the roofing characteristics. Variability in these factors may result in differences in the distribution function of pesticide and metal concentrations deposited near household entrances and may be related to exposure. Test is to determine if differential concentrations occur for different characteristics. If sample sizes are too small to allow a meaningful comparison of subgroups, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Clarification:

Question T7i- Yard material is synonymous with landscaped area, and the answer "soil" could also be gravel or dirt.

Question T7j- The answer "slab" indicates that the floor and foundation material are cement. "Crawl space" means a raised foundation.

Question T8a:

Does this house or apartment have a swimming pool?

Question T8b:

Where is the swimming pool located?

Question T9a:

Does this house or apartment have a hot tub or jacuzzi?

Question T9b:

Where is the hot tub or jacuzzi located?

Rationale:

Inhalation and dermal exposure to waterborne pollutants can be of the same order of magnitude as ingestion exposure for a typical individual. Swimming pools and hot tubs may be correlated with high-end personal exposures, particularly to waterborne VOCs. Test if differential concentrations occur in the presence or absence of sources. If sample sizes are too small to allow a meaningful comparison of subgroups, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

ARIZONA ONLY

Question T10

Rationale:

Subject Tracking

The Arizona Study will follow all members of the household to maximize the data yield. This creates a special need for accurately numbering and tracking all subjects. The

table is filled out in the lab from preceding household visits and contains the Roster number (Individual Respondent Number or IRN); the subject's first name of record, the date of birth (DOB), the Relationship to the index (or primary respondent). This information can be cross referenced on all forms in addition to the subject number. Relationships and DOB facilitate separation of forms when two people have the same first name. Bedroom number corresponds with the room number of the household diagram. This enables the research to evaluate exposure to samples collected in the bedroom where subjects sleep away a third of their day.

The second IRN# column is for subjects who are living in the home and not found on the roster. A sequential IRN number is assigned. Change in resident status helps us track subjects who have left the home. Such tracking facilitates identification of subjects in reconfigured families. Since we are following 125 families twice and 50 families four times, we expect to see divorce, remarriage, birth and death. We have used this information in the past studies and know it is essential. Failure to adequately track subjects results in loss of data.

Question T11:

Household Diagram

Rationale:

Household volume serves to characterize the home. Concentrations of pollutants found in dust may vary in conjunction with the household volume.

The appropriately labeled household diagram indicates where rooms are relative to one another. Doors and windows are indicated. It indicates the potential sources of particulate, VOC, and Metal contamination like fireplaces, heating and cooking units and ventilation ducts. The sample locations are indicated and their proximity to sources is recorded. If the high end of the demonstrated distribution is found in proximity to some aspects of the home, it will be important to know.

Question T12:

Characteristics of Floor Surfaces and Cleaning Utensils

Rationale:

Dust samples are being obtained from carpets in the home. This question characterizes each floor surface, reports floor cleaning during the preceding and during the sampling period and reports subjects who are likely to experience dermal or inhalation exposure from each floor surface. Differences in these parameters may influence subject exposure from floors.

Different vacuum cleaner types may have varying efficiencies in terms of removing and resuspending carpet contaminant for inhalation. Scotch Guard is widely used in Arizona to protect carpets and rugs from the ubiquitous dust of the desert. Use of Scotch Guard may be a source of target VOC's. Test if differential exposures/concentrations occur for different floor surfaces, cleaning methods and activities. In some cases, sample sizes may be too small to perform a meaningful statistical analysis in this phase of NHEXAS. For those cases, the information collected here will be used to identify possible cause of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Clarification:

Many homes will have linoleum floor coverings. A room with a linoleum floor should be classified as in the "hard surface" category and noted.

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FOLLOWUP QUESTIONNAIRE

Question F1:

In the past week, were any of the following items used in your home?

Rationale:

To estimate the type, duration and frequency of use of ventilation systems which are important when air sampling and dust collection are carried out. Air conditioner use may reduce exchange rates with outdoor air; evaporative coolers increase these rates, but offer some filtration of incoming air through dampened pads. Internal fan use increases the "mixing" within a building and window fans may increase air exchange rates, and exhaust fans may assist in removing pollutants from nearby their sources (prior to mixing).

Test if differential air/dust concentrations and personal air levels occur as a result of use. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Clarification:

In questions F1g through F1o please circle the correct number which represents the total number of days used.

Questions F1m- An electrostatic precipitator is a device separate from your heater which is used to take dust out of the air.

Question F2:

In the past week, did (you/he/she) spend any time using (any of the following)?

Rationale:

To estimate the frequency of use for major categories of residential sources of chemical exposure (including benzene and other VOC's, PAHs and pesticides). The use of these products may influence indoor or outdoor concentration of these pollutants in several media (i.e., air, on surfaces, in house dust or soil, and possibly food stored, prepared or eaten in the contaminated area). Personal exposure and dose may be higher for the active user than for others nearby. Washing hands following use may reduce the exposure duration following dermal contact with the product.

Test if differential exposures occur as a result of activity. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

- a. paints or solvents (thinners or removers)?
- b. glues or adhesives?
- c. petroleum products?
- d. gas-powered lawn mower?
- e. chain saw or other gas-powered equipment?
- f. sander?

Rationale:

Active use of these products may cause elevated exposures to some of the target pesticides as evidenced by biological measures, personal air measures, and stationary air measures through inhalation and dermal exposure.

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g. insecticides, pesticides, herbicides...?

Rationale: Active use of these products may cause elevated exposures to some of the target pesticides as evidenced by biological measures, personal air measures, stationary air measures, and surface dust measures.

Clarification: Question F2g is asking "If the product preparation yourself?" Did you prepare the product?

Question F3: In the past week, did (you/he/she) spend any time (doing any of the following activities)?

Rationale: Test if differential exposures occur as a result of doing activities. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

- a. Vacuuming?
- b. Sweeping?
- c. Dusting?

Rationale: These activities may result in increased levels of suspended particles in indoor air and may also help to explain elevated levels of metals and semivolatile pesticides in air.

- d. Lawn mowing or edging?
- e. Gardening?

Rationale: These activities may result in increased exposures to metals and pesticides that may be found in soil, lawns, and foliage in the yard of the residence.

- f. Woodworking?
- g. Metal working/welding?

Rationale: What is the rationale?

Question F4: In the past week, did (you/he/she) do any of the following activities?

Rationale: To determine residential exposure to BaP from cooking or burning food and burning rubbish and leaves.

Test if differential exposures/concentrations occur as a result of activities. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question F5: During the past week, did you or anyone else park a car or other motor vehicle in (any of the following areas)?

Rationale: Gasoline is a significant or major source of benzene fumes. Exposure to fumes in an attached garage or carport may make a major contribution to total inhalation exposure to benzene.

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Test if differential exposures/concentrations occur as a result of activities. For groups where the sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question F6:

Please tell me the names of any medications (you/he/she) took during the past week. Include those drugs which a doctor prescribed, any (you choose/he/she chooses) (yourself/himself/herself) "over the counter," and any nontraditional (herbal) medications. (PROBE FOR MEDICATIONS IN THE CATEGORIES LISTED; i.e., diuretics, chelating agents, antacids, hormones.)

Rationale:

These medications may affect the uptake or elimination of metals in particular and other pollutants in general.

Test if different levels of biological markers occur for those using and not using. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Clarification:

Please include over-the-counter cold medication Tylenol, Advil etc.

Question F7:

Please tell me whether you took any vitamins or mineral supplements during the past week. (PROBE FOR MINERAL SUPPLEMENTS IN SUPPLEMENTS IN CATEGORIES LISTED - CALCIUM, SELENTIUM, AND CHROMIUM SUPPLEMENTS)

Rationale:

Vitamins or mineral supplements may contain trace levels of metal pollutants or affect the uptake or elimination of metals.

Test if differential levels of biological markers occur for those using and not using. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Question F8:

Are you currently expecting a baby or nursing a baby?

Rationale:

Child bearing and lactation produces changes in hormonal and metabolic functions and rates. A significant change is in the mobilization of calcium from bone, bringing along possible lead that had been deposited from long time past exposure. Thus, biological marker levels will be altered and different from non-child bearing or lactating mothers.

Examine the relationship between exposure and biological marker levels.

Question F9:

About how many times did (you/he/she) eat each of the following foods last week, that is, while (you were/he/she was) participating in this study?

Rationale:

Test if differential exposures occur for those eating certain types of food. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes

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of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

- a-d. Any of the following vegetables: broccoli, cauliflower, Brussels sprouts, cabbage, cole slaw, sauerkraut, mustard greens, collards, Swiss chard, turnips, or rutabagas?

Rationale: e. Grapefruit or grapefruit juice?

Rationale: f. Alcoholic drinks?

Rationale: g. Any foods that have been grilled, barbecued, or flame broiled?
h. Any foods that have been smoked?
i. Any foods that have been charred by burning?

Rationale: Foods that have been grilled, barbecued, flame broiled, smoked or charred may be a source of PAH exposure.

Question F10: *During the past week, (were you/was he/she) on any kind of diet either to lose weight or for any other reason? If yes, what diet or diets (were you/was he/she) on?*

Rationale: Dieting can affect intake of foods and associated contaminants. Also, dieting may explain lower than expected amounts of collected foods. Provides information that may be used to assess or flag measured intakes.

Sample collection outlier check. Test if differential exposures occur for dieting/nondieting population groups. For groups where sample size is too small to allow a meaningful statistical analysis in this phase of NHEXAS, the information collected here will be used to identify possible causes of differences in exposures and to develop testable hypotheses for Phase II of NHEXAS and other follow-up studies.

Questions F12-F38: *How often (do you/does your child) typically do the following activities?*

Rationale: To estimate the annual frequency of activities that are likely to bring an individual into contact with one or more of the NHEXAS target compounds. The annual frequencies will be used to test the accuracy of the pre-pilot exposure assessments in predicting annual exposures. The Harvard University Consortium is conducting pre-pilot exposure assessments for the State of Arizona and the six States in Region 5 for target compounds -- benzene, toluene, lead, arsenic, chlorpyrifos and diazinon. In these assessments distributions of concentrations for each environmental medium will be estimated and combined with information on activities, intake rates, and other factors to produce a distribution of doses. Calculating and adding doses serves to put exposures by all routes on the same basis and allows summing to determine average and high end doses for each of the target chemicals resulting from multi-media exposure. It also allows comparison of the doses by pathway and route so that the most important exposures can be identified. Concentrations and doses experienced over one week (the approximate time for one visit or cycle in the NHEXAS studies) and over one year will be estimated in the pre-pilot assessments using available information in the literature and EPA databases. In the post-pilot assessment, distributions will be developed for each individual in the samples. Information provided by each respondent on annual

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frequency of exposure events will be substituted in the exposure equations, and concentrations and doses will be recalculated and compared to the pre-pilot assessments.

The annual frequencies will also be used to assess the ability of the questionnaire data, combined with measurements of short-term average exposure concentrations to predict long-term exposures and doses. In many EPA risk assessments, chronic exposure over a year to a lifetime is of as much or greater concern as short-term exposure. Almost all existing monitoring data and most activity pattern data represent periods of exposure much shorter than a year. One of the activities of NHEXAS is to investigate the accuracy of predicting chronic exposures from short-term data. To that end, some of the subjects in the NHEXAS studies will be revisited from one to seven times. Additional environmental samples will be collected and follow-up questionnaires and diaries will be readministered. Information on frequency and duration of activities during collection of monitoring data will be reported for 2 to 8 weeks over about 12 to 15 months for a subset of the respondents. The information provided in responses to questions F11-F38 will be compared to the activities reported in the weeks of the study to assess the ability of the weekly visits to capture high end exposure that could result from rare or seasonal events that might not be captured in the monitoring cycle.

Calculation of distributions (by chemical and exposure route) composed of annual doses for each member of the sample. Parameters of each distribution will be compared to parameters of the prior distribution calculated in the pre-pilot exposure assessment. Comparison of annual frequency estimated from questionnaire data on study-week activities to annual frequency reported in F11-F37.

Question F11:

Pump gas.

Rationale:

Annual frequency of inhalation exposure to benzene in gasoline.

Question F12:

Spend time in an enclosed parking garage or motor vehicle service garage.

Rationale:

Annual frequency of inhalation exposure to benzene in gasoline.

Question F13:

Get gasoline on skin.

Rationale:

Annual frequency of dermal exposure to benzene in gasoline.

Question F14:

Ride in a taxi, bus, car, truck, or van or other enclosed motorized vehicle.

Rationale:

Annual frequency of inhalation exposure to benzene in gasoline and outdoor air.

Question F15:

Ride on a motorcycle, tractor, lawn mower, or other unenclosed vehicle.

Rationale:

Annual frequency of inhalation exposure to benzene in gasoline and outdoor air.

- Question F16:** *Spend time in a room with someone who was smoking.*
- Rationale:** Annual frequency of inhalation exposure to benzene and other target compounds.
- Question F17:** *Spend time in a vehicle with someone who was smoking.*
- Rationale:** Annual frequency of inhalation exposure to benzene and other target compounds.
- Question F18:** *Paint walls, furniture, cars, or other objects.*
- Rationale:** Annual exposure to volatile organic compounds (VOCs), especially toluene, in paint.
- Question F19:** *Use chemical paint strippers to remove paint.*
- Rationale:** Annual frequency of inhalation and dermal exposure to VOCs, especially toluene, in paint strippers.
- Question F20:** *Remove paint by other methods (scraping, heat gun, sanding).*
- Rationale:** Annual frequency of inhalation and ingestion exposure to lead when coupled with information on age of housing.
- Question F21:** *Use paint thinners.*
- Rationale:** Annual frequency of inhalation and dermal exposure to VOCs, especially toluene, in paint thinners.
- Question F22:** *Use glues or adhesives at your home.*
- Rationale:** Annual frequency of inhalation and dermal exposure to VOCs, especially toluene, in glues and adhesives.
- Question F23:** *Mix pesticides from concentrate.*
- Rationale:** Annual frequency of inhalation and dermal exposure to pesticides.
- Question F24:** *Apply pesticides to control insects indoors.*
- Rationale:** Annual frequency of inhalation and dermal exposure to pesticides.
- Question F25:** *Apply pesticides to control insects outdoors.*
- Rationale:** Annual frequency of inhalation and dermal exposure to pesticides.
- Question F26:** *Apply pesticides to a pet or other animal.*
- Rationale:** Annual frequency of inhalation and dermal exposure to pesticide.
- Question F27:** *Apply pesticides or herbicides to lawns or foliage.*
- Rationale:** Annual frequency of inhalation and dermal exposure to pesticides.
- Question F28:** *Swim in a swimming pool.*
- Rationale:** Annual frequency of inhalation, dermal and ingestion exposure to chloroform.

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Question F29: ***Use a hot tub or jacuzzi.***

Rationale:

Annual frequency of inhalation, dermal and ingestion exposure to chloroform. Scientists in the Office of Science and Technology, EPA Office of Water, have identified this activity as possibly leading to high exposures to chloroform and other trihalomethanes, since Bromine is often used instead of chlorine to treat these systems.

Question F30: ***Lie or sit on carpets or rugs inside your home.***

Rationale:

Annual frequency of dermal contact with and ingestion of household dust that may contain target pesticides and metals.

Question F31: ***Lie or sit on uncarpeted floor (wood, linoleum, tile etc.) inside your home.***

Rationale:

Annual frequency of dermal contact with and ingestion of household dust that may contain target pesticides and metals.

Question F32: ***Garden in your yard in season.***

Rationale:

Annual frequency of dermal contact with and ingestion of soil that may contain target pesticides and metals.

Question F33: ***Get soil, dirt, or dust from your yard, porch, or patio on your skin.***

Rationale:

Annual frequency of dermal contact with and ingestion of soil that may contain target pesticides and metals.

Question F34: ***Make dermal contact with grass or foliage in your yard.***

Rationale:

Annual frequency of dermal contact with target pesticides and metals on grass and other foliage.

Question F35: ***Eat food grown or produced in your garden or farm when in season.***

Rationale:

Annual frequency of consumption of food that may be contaminated by uptake or target metals and pesticides from soil and deposition of target metals and pesticides from air.

Question F36: ***Put paint chips in mouth.***

Rationale:

Annual frequency of ingestion exposure to lead in paint.

Question F37: ***Eat soil or dirt.***

Rationale:

Annual frequency of ingestion exposure to target metals and pesticides through ingestion of contaminated soil.

Question F38: ***Chew on furniture, carpet or window sills.***

Rationale:

Annual frequency of direct ingestion exposure to target metals and pesticides in house dust.