

The Arizona Border Study

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

Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona
Tucson, Arizona 85721

Cooperative Agreement CR 824719

Standard Operating Procedure

SOP-UA-F-24.0

Title: Operation and Maintenance of the EcoChem Real-time Ambient
Air PAH Monitor

Source: The University of Arizona

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

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

Operation and Maintenance of the EcoChem Real-time Ambient Air PAH Monitor

1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) describes the general procedures to be followed for the operation and maintenance of the EcoChem real-time ambient air PAH monitor. This procedure must be followed to ensure consistent data retrieval of PAH measurements for the AZ Border project and other Health and Environment projects.

2.0 DEFINITIONS

- 2.1 AZ BORDER = The US border region is defined as 100 km north of the border. In this study, we define the border as 40 km north of the border. The Arizona Border Study or "Border AZ" is an alias for "Total Human Exposure in Arizona: A Comparison of the Border communities and the State" conducted in Arizona by the University of Arizona / Battelle / Illinois Institute of Technology Consortium.
- 2.2 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.
- 2.3 FIELD STAFF = The Field Coordinator, the Team Leader and the Team Members.
- 2.4 HOUSEHOLD (HH) = The residence occupied by the study respondent(s)
- 2.5 PAH = Polynuclear Aromatic Hydrocarbons
- 2.6 PAH MONITOR = Real-time ambient PAH monitor that operates on the principle of photoelectric ionization of PAH adsorbed on the surface of primarily carbonaceous aerosols.
- 2.7 PICOAMP = Measure of electrometer current
- 2.8 QUALITY ASSURANCE (QA) = All those planned and systematic actions necessary for ensuring the accuracy, validity, integrity, preservation and utility of collected data.
- 2.9 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.
- 2.10 RESPONDENT = A person in the study population of NHEXAS Arizona project, AZ

border and other Health and Environment projects. Each household is assigned an HHID. All respondents are assigned an Individual Respondent Number (IRN). Each respondent can be uniquely identified by an HHID, IRN combination.

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

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

3.0 REFERENCES

3.1 EcoChem Summary Operations Guide for the Ambient Air PAH Monitor

4.0 DISCUSSION

4.1 The PAH monitor operates by photoelectric ionization of PAH adsorbed on the surface of primarily carbonaceous aerosols. An internal pump draws air at 4 L/min into the instrument, where it passes through an electrofilter (an electrostatic precipitator, ESP) that is designed to remove charged particles or gas molecules. The air then flows through an ionization chamber, where ultraviolet (UV) light at 185 nm ionizes the PAH on particle surfaces, while gases and particles with no PAH remain neutral. The photoemitted electrons and gases are removed from the airstream by diffusion or acceleration through an applied electric field. Positively charged particles remaining in the airstream are collected on a filter inside an aerosol electrometer, where the charge is measured. The electrometer current (measured in picoamps) is proportional to the amount of PAH present and the response factors for the particular PAH on the surface of the particles.

4.2 The relative timing of the PAH monitor operation to other sampling types is shown in figure 2.

5.0 RESPONSIBILITIES

Real-time sampling of indoor and outdoor air for PAH will be performed by University of Arizona personnel with assistance, where necessary, from members of Battelle's Atmospheric Science and Applied Technology Department.

Any person who amends or alters this procedure is responsible for ensuring that the changes have been properly documented, the SOP changed, reviewed, and reissued.

5.1 The project director is responsible for:

The final review and approval of this procedure.

5.2 The Team Leader is responsible for:

- (a) arranging sampling dates and times with the HH;
- (b) quality control checks in the field.

5.3 All Team Members are responsible for:

- (a) proper monitor operation;
- (b) completion of field sheet (fig. 1);
- (c) ensuring that the measurements are downloaded from the PAH monitor to the lap-top computer in the field (when applicable);
- (d) quality control checks in the field;
- (e) Save the field data to a disc and print out the file that corresponds to each household when return from the field.

5.4 The Field Coordinator is responsible for:

- (a) 100% QA check of field forms;
- (b) performing 10% QA in-field audit of collection methods.

6.0 MATERIALS AND EQUIPMENT

6.1 The PAH monitor is mounted in a 17.5 in. x 6.5 in. x 6.5 in. chassis that weighs approximately 24 pounds. The front panel of the monitor consists of a digital display, a zero adjust screw, a status lamp, and a settings switch. The air intake port is also mounted on the front panel. The internal sample pump draws air through this intake at about 4 L/min.

6.2 The back panel of the PAH monitor includes the power outlet for the monitor (110v/60 Hz), a nine pin RS232-C outlet, and a two-pen outlet for analog signals. The voltage range of the analog output is -5 to 5 volts. An output of 0 volts corresponds to 0 picoamps of photoionization current. An output of 5 volts corresponds to either 2 picoamps or 20 picoamps, depending upon the position of the front panel settings switch.

6.3 Lap-Top computer for the electronic storage of the field measurements.

7.0 PROCEDURE

7.1 Startup

7.1.1 Starting the Monitor

- (a) Place the monitor at the center of the indoor area to be sampled (area in which the primary respondent spends most of the time). Place the monitor in a location where the air intake port on the front panel will not be obstructed. Keep the air intake free of any loose dirt or debris that can easily be sucked-up by the intake and cause a blockage.
- (b) Connect the monitor to a 110 Volt/60 Hz power source and toggle the Power switch to the <On> position.
- (c) Turn the front panel settings switch to the position marked <2> or <20>.
- (d) After 1 to 2 minutes, the status lamp on the front panel should change from Red to Green. The lamp should indicate Green to denote proper operation of the monitor. If the status lamp does not change from Red to Green, consult page three of the Summary Operations Guide (see Step 3.1).
- (e) After a warm-up period of 30 minutes (time to reach full sensitivity), perform the **Zero Adjust** procedure.

7.1.2 Zero Adjust

- (a) Turn the front panel switch to the position marked <Zero>
- (b) Wait for 30 seconds and the numeric display should indicate <0.000>.
- (c) If the monitor does not read <0.000>, use a small screwdriver to set the reading to <0.000> by turning the Zero Adjust screw. Start with a negative value and turn the screw until the negative sign indicator just turns off.

7.2 Measurement

7.2.1 Digital Display

The front panel of the monitor displays the photoionization current in picoamps on a digital display. When the settings switch is in the <2> position, the digital display can vary from 0 to 2 picoamps and three decimal places are displayed. When the settings switch is in the <20> position, the digital display can vary from 0 to 20 picoamps and two decimal places are displayed.

7.2.2 Taking the Readings

- (a) Connect the Lap-Top computer (if available) to the PAH monitor.

- (b) After performing the zero adjust procedure, turn the settings switch to the position marked <2>. If the reading on the digital display is less than 2.000, leave the settings switch in this position and record the reading on the digital display, the time, and the range (<2>) on the data sheet. If the digital display is saturated at 2.000, turn the settings switch to the <20> position to change the range to 0 to 20 picoamps. Record the reading on the digital display, the time, and the range (<20>) on the data sheet if a lap-top computer is not available in the field.
- (c) Approximately 15 minutes after recording the first reading, check the digital display to make sure that the display is on scale, as described in Step b. Again, record the reading on the digital display, the time, and the range on the data sheet again (if a lap-top computer is not available in the field.).
- (d) After approximately 30 minutes, check the digital display to make sure that the display is on scale, as described in Step b. Record the reading on the digital display, the time, and the range on the data sheet (if a lap-top computer is not available in the field.) for a third time.
- (e) The PAH monitor can now be turned off by toggling the power switch to the <Off> position.
- (f) Insert a disc in the lap-top (if available) and save the data in a file named "HHIDA.IND". So for example of the Household ID is 123456A, the file name will be 123456A.IND (IND stands for Indoors).
- (g) Move to the outdoor sampling site, at least 10 feet away from the wall of the house and 10 feet away from any other sampler. Repeat steps (a) - (g).
- (h) Insert a disc in the lap-top (if available) and save the data in a file named "HHIDA.OUT". So for example of the Household ID is 123456A, the file name will be 123456A.OUT (OUT stands for Outdoors).

7.3 Sample Shipment - N/A

7.4 Analysis

7.4.1 Standards/Blanks - N/A

7.4.2 Samples - N/A

7.5 Calculations - N/A

7.6 Quality Control

7.6.1 QA and QC duplicate/replicate sampling will not be performed.

7.6.2 Tolerance Limits

Sampler site location is flexible within the bounds of safety and security. When feasible, the sampler should be located 10 feet of any wall and 10 feet of any other sampler.

7.6.3 Detection Limits - Pending

7.6.4 Corrective Actions

Apparent mis-labeling problems detected in the field may be corrected by the team members when appropriate in accordance with SOP # UA-C-2.X.

8.0 RECORDS

8.1 All measurements will be kept electronically in a computer disc into a file that correspond to the household, and a printout of the file will be kept with the other field forms.

If a computer is not available in the field, all analytical results are recorded on a PAH Analyzer Sampling Data Sheet, an example of which is shown in Figure 1. When back from the field they will be transferred to an electronic format for consistency.

8.2 Each measurement is recorded with the time, date, location code (HHID), sampling site, and additional comments (if needed).

8.3 Maintenance logbooks will be kept.

Figure 1. PAH Analyzer Sampling Data Sheet**PAH ANALYZER SAMPLING DATA SHEET**

Date	
PAH Analyzer ID	
Location (Indoor or Outdoor)	
Time	
Range (<2> or <20>)	
PAH Reading 1 (picoamps)	
Time	
Range (<2> or <20>)	
PAH Reading 2 (picoamps)	
Time	
Range (<2> or <20>)	
PAH Reading 3 (picoamps)	

Figure 2. Relative Timing of Sample Collection (Page 1 of 3)

Sample Collection: Relative Timing

Stage 1 (n=300)

Questionnaires:

Descriptive

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
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Stage 2 (n=125)

Questionnaires:

Descriptive Update
Baseline
Diet Diary *
Time / Activity *
Technician
Supplement

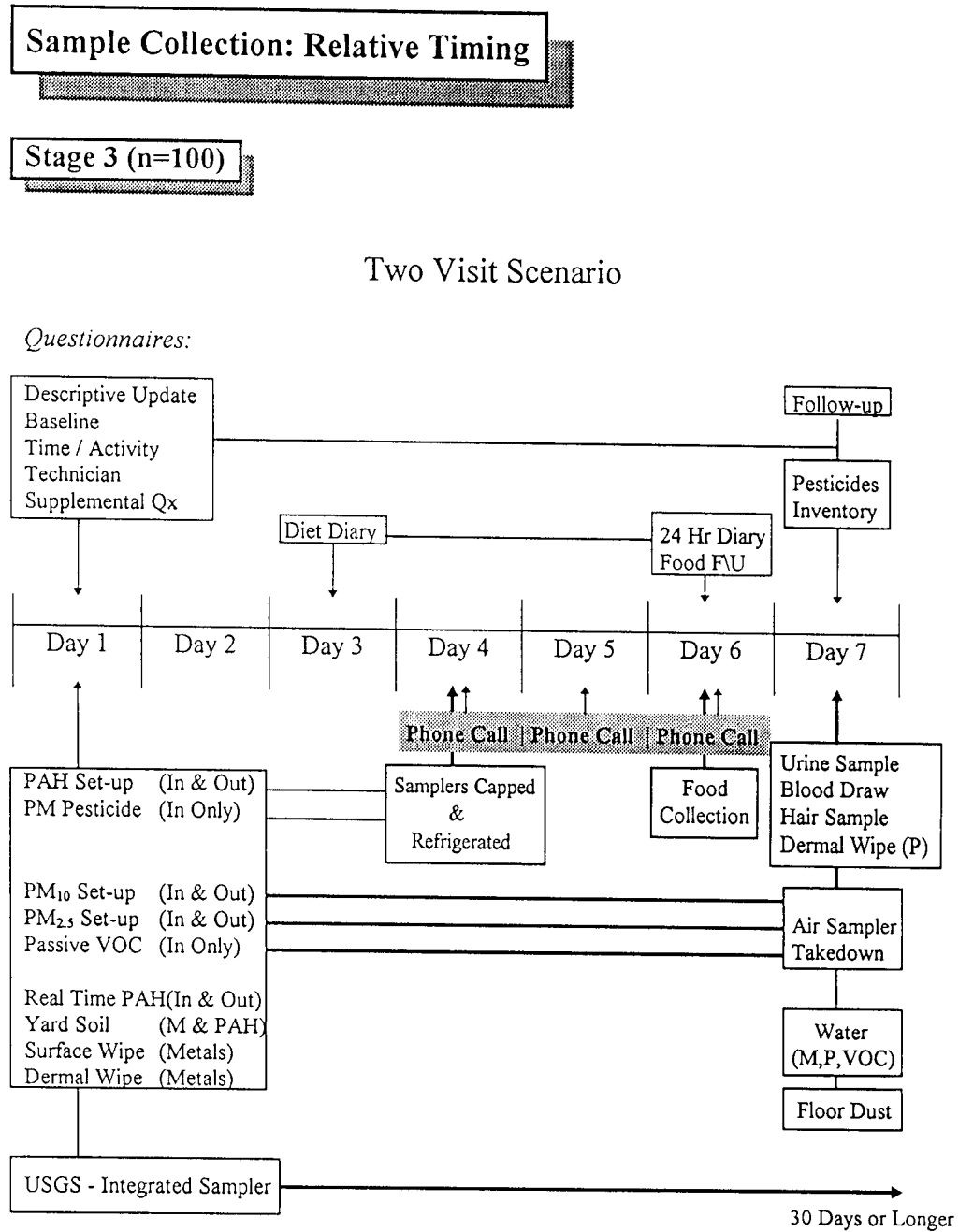
* One day recall

Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
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Sample Collection:

Yard Soil
Floor Dust

Figure 2. Relative Timing of Sample Collection (Page 2 of 3)



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

Figure 2. Relative Timing of Sample Collection (Page 3 of 3)

