## Protocol for Air Monitoring in Multi-Unit Housing

**Public reporting burden of this collection of information is estimated to average 90 minutes per response (30 minutes for equipment set up, 30 minutes for pick up and 30 minutes for completing diaries) , including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC/ATSDR Reports Clearance Officer; 1600 Clifton Road NE, MS D-74, Atlanta, Georgia 30333; ATTN:  PRA (0920-xxxx)**

## Overview

This protocol defines the procedure for the 1-week monitoring of air quality  in individual residential units of a building. Two data sheets are included in the protocol, one for collecting basic monitoring data (Attachment 6B) and one for collecting time-diary information (Attachment 6A).   It is vital that the protocol is strictly followed for each site visit.

This document contains checklists for the required equipment needed for each monitoring trip, as well as for the components of the data sheets and the tasks to be performed by Field Data Collectors, lab technicians, or data analysts.

## Checklist of Required Equipment for Each Monitored Residence

- ☐ 1 x Sidepak Aerosol Monitor
- ☐ 1 x Dylos Particle Monitor
- ☐ 1 x Particle filters with cassette
- ☐ 1 x nicotine filter with cassette
- ☐ 1 x Impactor for respirable particle sampling
- ☐ 1 x Leland high-volume pump for particle sampling with tubing
- ☐ 1 x Gilair pump for nicotine sampling with tubing
- ☐ 2 x 5-gallon bucket or similar container with cover, padding, and aluminum inlets
- ☐ 1 x power strip
- ☐ 1 x power extension cord
- ☐ 1 x basic data sheet (completed by investigator)
- ☐ 10 x daily time diary sheets (completed by occupant each of 7 days with 3 extra sheets)

## Checklist for the *Basic Monitoring Data Sheet (completed by Field Data Collectors)*

The Field Data Collector who is visiting each home, must complete a sheet of basic data, which will be vital for data analysis and quality assurance. This sheet provides important general information about the timing of the monitoring, the equipment used, its placement in the home,

etc. The same sheet will be used for both the initial and return visits. _Note_: Building or behavioral information that may need MUH resident input will not be included on this basic monitoring data sheet, but will be included in the MUH Resident Survey instrument. The basic data monitoring sheet template is included in a separate document. The components of this data sheet are listed below:

- Name(s) of Field Data Collector;
- House Identification Number;
- Date of First Visit;
- Date of Return Visit;
- Time Monitors Started (Sidepak, Dylos);
- Time Monitors Stopped (Sidepak, Dylos);
- Pumps set to turn on and off automatically (yes/no);
- Time Pumps started (if not automatic);
- Time Pumps stopped (if not automatic);
- Air Flow of Sidepak checked (yes/no);
- Air Flow of Pumps checked (yes/no);
- Zero Calibration of Sidepak (yes/no);
- Memory of Sidepak cleared (yes/no);
- $PM_{2.5}$ Impactor on Sidepak (yes/no);
- Location of monitors (main living area);
- Monitor Identification Numbers;
- Approximate description of where tobacco smoke odor detected (hotspots);
- Rough schematic drawing with monitor position and approximate hotspots; and
- Additional notes on special circumstances, difficulties, etc.

**Checklist for the _Daily Air Diary Data Sheet (completed by MUH residents daily)_**

Precise and complete information on time-based events is vital so that airborne particle concentrations and episodes of elevation levels can be reliably linked to specific activities or circumstances. Events fall into four categories related to: (1) Occupancy and Sleep Patterns; (2) Tobacco Smoke Odor; (3) Other Particle Generating Activities; and (4) Ventilation and Circulation. A designated MUH resident (the "respondent") will be directed to fill out **one time-diary data sheet per day** (for the previous day's events) with specification of activities during four 6-hour time periods  formatted as four separate rows with identical form elements (**Attachment 6A**).  The respondent will check boxes for appropriate answers or, occasionally, enter text into a cell if the answer is not listed.  Below is a summary list of the components of the time-diary sheet.

For each time period (row):

| | |
|---|---|
| Column ONE: | Was respondent, other adults, or any children home during a given time period? |
| Column TWO: |  Did anyone detect tobacco smoke odor? |
| Column THREE: |  In which room was the tobacco smoke odor strongest? |

Column FOUR:      Was any cooking done by anyone with the stove or oven?
Column FIVE:      Were any other particle events done by anyone?
Column SIX:       Did anyone do anything to increase air movement?
Column SEVEN:     How long did any activities last that resulted in increased air movement?


**Checklist of Protocol Tasks – Before, During and After Visits**

*A, Before Initial Visit: LACDPH Staff Calibrate Sidepak and Dylos monitors and pre-weigh sample filters*

1) Perform chamber calibration of real-time monitoring units for a range of tobacco smoke Concentrations ( e.g., 20, 60, 100, 200 micrograms per meter cubed).
2) Compare real-time data to mass standard (TEOM or filter samples).
3) Create calibration curve using linear regression.
4) Obtain mass calibration factor for each unit.
5) Pre-weigh a batch of filters noting temperature and relative humidity (use standard weighing protocol described elsewhere).


*B. Before Initial Visit: LACDPH Staff Prepare Monitors and other equipment for use*

1) Make sure you have everything listed on the equipment checklist, including ONE copy of **Basic Monitoring Data Sheet**, TEN copies of **Daily Air Diary Data Sheet**
2) Make sure you have the monitoring buckets or containers with inlets, power strip, and extension cord.
3) Verify that all equipment is functional and undamaged.
4) Make sure you have an accurate timepiece (nearest second) and a pen or pencil.
5) Make sure you have 1 pre-weighed sample filter for gravimetirc and 1 pre-treated nicotine filter,  both  placed in cassettes
6) Set Sidepak Calibration Factor to appropriate value based on calibration experiments.
7) Verify that Sidepak $PM_{2.5}$ impactor is installed and clean.
8) Verify Sidepak battery is charged.
9) Verify that Sidepak air flow rate is 1.7 LPM.
10) Zero calibrate the Sidepak monitor.
11) Verify Sidepak logging interval set to 1 minute.
12) Clear Sidepak memory.
13) Clear Dylos memory.
14) Assemble the pumps and filter cassettes with impactor for particle pumps.
15) Verify air flow rate of particle pump with impactor attached.
16) Set particle pumps to automatically start for a single 24-hour period during the 7-day sampling (e.g., starting at the beginning of sampling and ending 24 hours later).
17) Set nicotine pump to start for full 7-days sampling period
18) Place Dylos and Sidepak  equipment in a monitoring bucket.or container
19) Place particle and nicotine pumps in a separate bucket or container

*C. Field Data Collectors Initial Visit to Residence*

1) <u>Check out Sidepak/Dylos and Filter containers, coolers and other equiopment from official LACDPH pick-up location and personnel.  Insure the pick up is logged on the equipment Chain of Custody documentation.</u>
2) <u>Upon arriving at a residence, determine if respondents smelled tobacco smoke in previous week and room with strongest smell.  If tobacco smoke smell was reported in previous week, then will be monitored with pump-and-filter measurements.</u>
3) Place the monitoring bucket for Sidepak and Dylosin the main living area of the residence, finding a convenient electrical outlet. Bucket should be placed on the floor <u>away</u> from doorways, areas with high traffic, or close to areas where cooking or particle generating activities are likely to occur. If house is selected for filter-and-pump QA measurements, place $2^{nd}$ bucket or container in same location with particle and nicotine pumps.
4) Activate the monitors (and pumps if they are to be deployed).
5) Fill out the **Basic Monitoring Data Sheet (below)**, including investigator names, house ID, dates and times, ID's of all equipment used. Fill out the **Layout Sketch** form (one for each floor of the apartment, if the apartment covers multiple levels) containing  a rough sketch of the rooms of the home  with position of monitoring package (main living area). Measure and note the approximate dimensions of the room containing the monitoring package. Leave the Layout Sketch with the respondent to aid them in completed the Daily Air Diary (see below).
6) Instruct MUH resident(s) in how to fill out the Daily Air Diary **Data Sheets** (Attachment   6A) each day.

D. *Field Data Collectors Return Visit to Residence after Approximately 7 Days*
 *1)* Turn off monitors and pumps and note time on ***Basic Monitoring Data Sheet.***
 *2)* Fill out time and date on ***Basic Monitoring Data Sheet.***
 *3)* Make sure data was logged properly on Sidepak and Dylos.
 *4)* Note any anomalies, malfunctions, damage, or movement of monitoring package or monitors/pumps, or any other special or noteworthy circumstances.
 *5)* Wrap filters in foil and place in a cooler for transit.
 *6)* Collect ***Daily Air Diary Data Sheets*** from MUH residents.
 *7)* Remove monitoring buckets or containers from main living area.
 *8)* Return monitoring buckets or containers and coolers with filters with all other equipment to the official drop-off location and personnel at LACDPH.  Insure drop-off is noted on equipment Chain of Custody documentation.

E. *After Return Visit: Sample retrieval, processing, and archiving by LACDPH* staff
 1) **All data retrieval, processing, and archiving should occur within 1 or 2 days of the end of the 7-day monitoring period.**

2)  Download data from the Sidepak using Trakpro software into CSV (comma delimited) format. Use a file name containing house ID, monitor type, and date sampling ended, e.g., "***MUH_Sidepak_UnitA023_10-June-2013.CSV***".

3)  Download data from the Dylos using Hyperterminal software into plain text format. Use a file name containing house ID, monitor type, and date sampling ended, e.g., "***MUH_Dylos_UnitA023_10-June-2013.TXT***".

4)  Transfer Sidepak and Dylos data to Excel Spreadsheets with same names as CSV or TXT files <u>except with an XLS file extension.</u>

5)  Store filters (in foil) in freezer prior to weighing.

6)  Post-weigh the sample filters, noting temperature and relative humidity (follow standard weighing protocol described elsewhere).

7)  Enter sample filter post-weights to an Excel Spreadsheet named with House ID and Date (e.g., "***MUH_Filters_UnitA023_10-June-2011.XLS***").

8)  Make a scanned PDF document of all data sheets.and time-diary sheeets

9)  Transcribe all of the printed diary sheets to a single electronic Excel file, named with House ID and Date (e.g., "MUH_Time_Diaries_UnitA023_12-Aug-2012.XLS"

10)  Upload all electronic data (raw data files, Excel files, and scanned data sheets) to server archive (location TBD) in a single folder named with House ID and date (e.g., "***MUH_UnitA023_10-June-2011***").


*F.* <u>Per-site Quality Assurance and Data Analysis by LACDPH Staff</u>
1)  Make diagnostic plots of all real-time data.
2)  Verify data set is complete.
3)  Verify proper operation of all equipment.
4)  Repair and/or recalibrate equipment as needed.
5)  Obtain auxiliary ambient airborne particle data from local monitoring stations (e.g., from SCAQMD, [http://www.aqmd.gov/aer/DataInquiry.html](http://www.aqmd.gov/aer/DataInquiry.html)) for use in standardizing the final analysis on ambient levels.
6)  Create/update a standardized data base of all the on-site monitoring data and auxiliary ambient data. Data base should be in a format that is accessible by any industry-standard statistical package.
7)  Compare filter data to real-time data for a single 24-hour period to verify calibration and agreement with "gold standard" filter measures.
8)  Calculate descriptive statistics of particle levels (both on-site and ambient) for the 7-day sampling period, including overall means, variance, and maximum values by minute, hour, and day. Disaggregate by day-of-week (weekend versus weekday).
9)  Calculate ratio of Dylos and/or Sidepak responses to aid in elucidation of source types.
10) Using time-activity information and ratios, identify peaks and/or segments of elevated levels that are likely due to SHS. Generate descriptive stats for these segments alone.

11) Add time-activity information on frequency and duration of tobacco odor, other particle emissions, and ventilation events to the data base for use in standardizing the final analysis on these variables. (Exact procedure TBD).

## Air Monitoring Information Data Sheet – Completed by Field Data Collectors at Placement of Equipment

| **Air Monitoring: Basic Information Data Sheet** | | House ID# | |
|---|---|---|---|

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| | |
|---|---|
| Field Data Collector Name: | |

**Checklist**

___Floorplan sketch made?

___Floorplan & Air Diary forms left with respondent?

___Power strip connected to outlet & Sidepak/Dylos

___Sidepak in container

___Sidepak tubing attached to inlets

| | |
|---|---|
| Initial Visit Date (e.g,. 12/08/2012): | |
| Initial Visit Time (e.g, 8:00 PM): | |

___Sidepak functioning in LOGGING MODE

___Sidepak container cover closed

**Make Layout Sketch using the separate form & leave in home with respondent. Leave 10 copies of Daily Air Diary with Respondent.**

___Dylos placed on top of container

| | |
|---|---|
| Which room contains the monitoring package?: | |
| Did respondent report tobacco smoke smell sometime in the last week (circle)?: | YES      NO |
| Which room had strongest smoke smell? (refer to the Layout Sketch for room codes): | |
| # Homes With Tobacco Smell Monitored So Far?: | |

___Dylos functioning

**If Nicotine & Particle Filter Sampling Being Done:**

___Pumps connected to power & turned on

___Pump sample times set

___Pump tubing connected to inlets

**If respondent reports tobacco smell in the last week, then place particle and nicotine filters/pumps in the home IN ADDITION to the Sidepak & Dylos**

___Pump container cover closed

**Miscelleous Notes:**

**Information on Equipment Placed in the Home**

| | |
|---|---|
| Nicotine & Particle Filter/Pump Sampling in this Home (circle)?: | YES      NO |
| Sidepak ID#: | |
| Dylos ID#: | |
| Particle Pump ID#: | |
| Nicotine Pump ID#: | |
| Particle Filter ID#: | |
| Nicotine Filter ID#: | |
| Time All Sampler Active (e.g., 8:30 pm): | |

**Return Visit to Pick up Equipment**

| | |
|---|---|
| Return Visit Date (e.g., 12/08/2013): | |
| Return Visit Time (e.g., 7:30 PM): | |
| Time All Samplers Shut Down (e.g.., 8:00 PM): | |

# Example Room Layout Sketch

**Room Layout Sketch** Data Collector ____  Date ____  Building ID ____  Home ID ____

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Initials ____

Level #: ____   No. of Levels: ____

Note:  Use additional sheets for multiple levels.

**Draw the approximate layout of rooms in the home - Label rooms with abbreviations given below.**

**Include labels in upper left of rooms.    Draw an "X" for monitoring package location & include rough dimensions of this room.**

**Indicate front door with "FDR", stairs with "STRS", closets with "CL".  The street side of the home is along the bottom.**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

BED1

HALL1    BED2

CL

KIT    BATH1

LIV (14 x 16 feet; 8 foot ceiling)

DIN    **X**

FDR
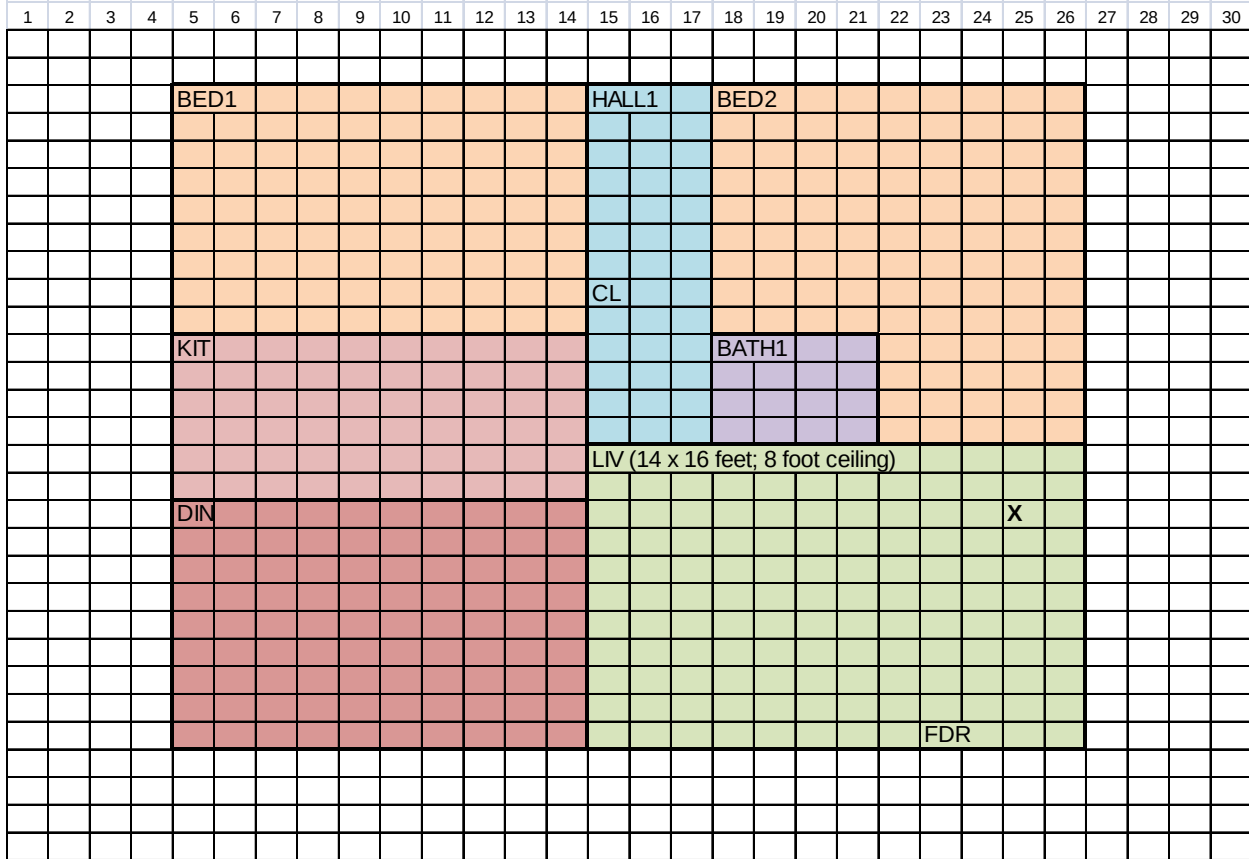
**Street Side**

## Key to Room Abbreviations (Consider Distinct Rooms Only):

| | | |
|---|---|---|
| BED1 = 1st Bedroom | BATH1 = 1st Bathroom | HALL1 = Hallway 1 |
| BED2 = 2nd Bedroom | BATH2 = 2nd Bathroom | HALL2 = Hallway 2 |
| BED3 = 3rd Bedroom | BATH3 = 3rd Bathroom | LAUN = Laundry/Utility |
| DIN = Dining Room | BAL = Balcony | DEN = Den/Recreation |
| KIT = Kitchen | PAT = Patio | OTH = Other Room |
| LIV = Living Room | LOB = Lobby | |

Reviewed by: ____
Initials: ____
Date: ____

Include closets in the space for bedrooms or hallways.