National Human Exposure Assessment Survey (NHEXAS)

Arizona Study

Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona
Tucson, Arizona 85721

Cooperative Agreement CR 821560

Standard Operating Procedure **SOP-IIT-A-5.0**

Title: Estimating Inhalation Exposures to Chlorpyrifos and Diazinon

Source: The University of Arizona

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

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STANDARD OPERATING PROCEDURE FOR ESTIMATING INHALATION EXPOSURES TO CHLORPYIFOS AND DIAZINON

This Standard Operating Procedure (SOP) uses data that have been properly coded and certified with appropriate QA/QC procedures by the University of Arizona NHEXAS team.

Objective

Calculate the inhalation exposure to chlorpyrifos and diazinon.

Exposure Calculation

The equation to be used for calculating exposure values via the inhalation route to pesticides is:

$$E = \sum_{i,j,l} C_{i,j,l} \times t_{i,j} \qquad (2\text{-}1)$$

where:

$C_{i,j,l}$ is the concentration of the i th pesticide, associated with the i th subject at the j th microenvironment.

$t_{i,j}$ is the time spent by the i th subject in the j th microenvironment.

The unit for exposure to each of the airborne pesticides is $(ng/m^3)(hr)$. At this stage of paper development, we do not intend to calculate the average Daily Dose though such calculations are not difficult.

The majority of the outdoor air concentration values in the NHEXAS Arizona are nondetectable. In addition, the number of detected samples are very small. Out of 42 households sampled, there are only 4 samples above the detection limit for Chlorpyrifos and only 9 samples above the detection limit for Diazinon. Therefore, the exposure to the chemicals in outdoor air is assumed to be equal to zero and the calculation in this SOP is for the indoor exposure only.

Variable List

Variable	Description
HHID	household I.D.
IH	Average time spent indoor by each respondent, hr
C_ZERO	measured concentration of chlorpyrifos in indoor air with the BDL values censored to be equal to zero. The unit is ng/m^3.
C_DL	measured concentration of chlorpyrifos in indoor air with the BDL values censored to be equal to the detection limit. The unit is ng/m^3.
C_RB	measured concentration of chlorpyrifos in indoor air with the BDL values censored using the robust method. The unit is ng/m^3.
D_ZERO	measured concentration of diazinon in indoor air with the BDL values censored to be equal to zero. The unit is ng/m^3.
D_DL	measured concentration of diazinon in indoor air with the BDL values censored to be equal to the detection limit. The unit is ng/m^3.
D_RB	measured concentration of diazinon in indoor air with the BDL values censored using the robust method. The unit is ng/m^3.
EC_ZERO	exposure to chlorpyrifos in indoor air, using the concentration data with the BDL values censored to be equal to zero. The unit is $(ng/m^3)(hr)$.
EC_DL	exposure to chlorpyrifos in indoor air, using the concentration data with the BDL values censored to be equal to the detection limit. The unit is $(ng/m^3)(hr)$.
EC_RB	exposure to chlorpyrifos in indoor air, using the concentration data with the BDL values censored using the robust method. The unit is $(ng/m^3)(hr)$.
ED_ZERO	exposure to diazinon in indoor air, using the concentration data with the BDL values censored to be equal to zero. The unit is $(ng/m^3)(hr)$.
ED_DL	exposure to diazinon in indoor air, using the concentration data with the BDL values censored to be equal to the detection limit. The unit is $(ng/m^3)(hr)$.
ED_RB	exposure to diazinon in indoor air, using the concentration data with the BDL values censored using the robust method. The unit is $(ng/m^3)(hr)$.

Procedure

The concentration data in each media will be censored with the approaches explained in SOP # 4. Generally, 3 sets of data resulted from the censored data treatment will be used in the exposure estimation:

1) Data set with all below detection limit values substituted by zero.
2) Data set with all below detection limit values substituted by the detection limit.
3) Data set with all below detection limit values substituted by values selected using the Robust Method.

The procedure explained next is for estimating unweighted exposure for the data sets. Weighted exposure estimates can be obtained by using the SUDAAN program. The unweighted exposure estimates, with corresponding sampling weights, will be used as the program's inputs. The sampling weights used will be calculated and adjusted according to the processes explained in details in SOP # 9 and 10.

The procedure for the unweighted exposure estimation in this SOP is the following:

1. In SPSS, open **TIME ACTIVITY**. This file contains the average time spent in each of the 7 microenvironments according to the Time Activity Questionnaire. Merge this file with the following censored concentration data files: **FFPIN BDL = ZERO CHLOR, FFPIN BDL = DL CHLOR, FFPIN BDL = RB CHLOR, FFPIN BDL = ZERO DIAZ, FFPIN BDL = DL DIAZ,** and **FFPIN BDL = RB DIAZ.** The first 3 files contain the concentration values of chlorpyrifos in indoor air with BDL values censored to zero, to the detection limit, and censored with the robust method, respectively. The last 3 files contain the concentration values of diazinon in indoor air with BDL values censored to zero, to the detection limit, and censored with the robust method, respectively. Exclude variables which are irrelevant to the exposure calculation. The merged file will then contain, for each respondent, the average time spent indoor at home and the 6 sets of concentration values of chlorpyrifos and diazinon. The variables include ***HHID, IH, C_ZERO, C_DL, C_RB, D_ZERO, D_DL,*** and ***D_RB.*** Save this file as **INHALATION EXPOSURE.**
2. In, **INHALATION EXPOSURE,** calculate inhalation exposure for each respondent by using equation 2-1. See spreadsheet format shown below. The calculated exposure results are in variables ***EC_ZERO, EC_DL, EC_RB, ED_ZERO, ED_DL,*** and ***ED_RB.***

Spreadsheet Format

In **INHALATION EXPOSURE**:

Column	Variable
1	***HHID***
2	***IH***
3	***C_ZERO***
4	***C_DL***
5	***C_RB***
6	***D_ZERO***
7	***D_DL***

Column	Variable
8	***D_RB***
9	***EC_ZERO***, calculated from ***C_ZERO*** × ***IH***
10	***EC_DL***, calculated from ***C_DL*** × ***IH***
11	***EC_RB***, calculated from ***C_RB*** × ***IH***
12	***ED_ZERO***, calculated from ***D_ZERO*** × ***IH***

Column	Variable
13	***ED_DL***, calculated from ***D_DL*** × ***IH***
14	***ED_RB***, calculated from ***D_RB*** × ***IH***