

Chapter 5

Field Monitoring

5.1 Overview

The CTEPP study collected environmental and personal samples as well as supplemental information to aid in the interpretation and assessment of the children's exposures to pollutants at homes or day care centers. For children who stayed at home during the day with their primary caregivers, field samples, questionnaires, and time-activity/food diaries were collected at their homes over a 48-h period. For children who attended day care, these above samples were collected at both their day care centers and homes simultaneously over a 48-h period. Household and center observation surveys, day care menus and other ancillary information were collected before or immediately after sampling.

Field staff collected samples of outdoor play area soil, indoor and outdoor air, indoor floor dust, and drinking water at homes and child day care centers. The adult caregiver collected duplicate diets, dermal (hand) wipes, and multiple spot urine samples for themselves and for their child while at home. The teachers collected the above samples for day care children while at day care. If a pesticide application had occurred inside or outside the home or day care center within the seven days preceding sampling or during the 48-h monitoring period, additional types of field samples were collected. These additional samples consisted of transferable residues (PUF roller samples), hard floor surface wipes, and food preparation surface wipes. Supplemental information was collected through pre- and post-monitoring questionnaires, house/building characteristic observation surveys, child/adult activity and food diaries, and day care food menus. In addition, 26 children were videotaped for about two hours in their homes in Ohio (OH) to supplement the questionnaires and activity diaries.

Field sampling started in North Carolina (NC) in July 2000 and was completed by March 2001. It was completed in the mountain and Piedmont regions by December 2000. However, field sampling in the two coastal counties was delayed because of the severe hurricane flooding that had occurred the previous year. In this region, field sampling was completed by April 2001. In OH, there were no significant delays in field sampling activities at participants' homes and/or day care centers. Field sampling started in late April 2001 in urban counties, Franklin and Licking, in central OH, because of their close proximity to Battelle's facility in Columbus, OH. Field sampling was completed in the rest of central, northern and southern regions of the state by November 2001. Overall, field samples were collected at a total of 130 homes and 13 day care centers in NC, and at 127 homes and 16 day care centers in OH.

5.2 Field Data Collection

Table 5.2.1 summarizes the field data collection procedures and sampling activities that took place over a 48-h period at a participant's home and/or day care center. This approach was used for both the NC and OH field studies. There were three field sampling teams (labeled as teams A, B, and C), with two staff members in each team. Two field sampling teams, A and B, collected the field data simultaneously at different homes or day care centers. A third field sampling team, C, served as a backup team and was responsible for field preparation and training participants.

Subjects were scheduled in the same cluster of locations within a county in the same sampling week. The time needed to complete the field sampling work for each state was about 24 to 30 weeks, depending on the availability of the participants and the weather. One week prior to each scheduled sampling date, the participants were trained to collect urine, hand wipe and food samples, and were given instructions for filling out the Child Activity Diary. At that time, they were given the opportunity to ask additional questions and voice any concerns they had about their participation.

For stay-at-home participants, field sampling activities took place at the households of approximately eight children per week. These activities occurred over a 48-h period for three consecutive days. Typical sampling schedules were: (1) Monday to Wednesday, (2) Tuesday to Thursday, or (3) Wednesday to Friday. The initial sampling appointments generally ranged from 7 a.m. to 8 p.m; sampling began shortly thereafter and continued for the following 48 h. In a given week, field sampling activities began at four households on Day 1, and each of two field teams was responsible for the activities at four households per week.

For day care participants, field sampling activities occurred at one day care center per week, representing from four to six participating children. Sampling activities also occurred at the households of these children during that week. Field sampling took place simultaneously during a 48-h period at each child's day care center and at her/his home. In a given week, field sampling activities began at the day care center and at the households of two or three children on Day 1, and each of two field teams was responsible for the activities at two or three households per week.

5.2.1 Environmental and Personal Samples

All field sampling procedures were conducted according to Standard Operating Procedures (CTEPP-SOPs: 2.10 - 2.27). The list of all CTEPP SOPs is presented in Appendix A. The multimedia samples that were collected at the children's homes and day care centers are described below, in Sections 5.2.1.1 through 5.2.1.10.

Table 5.2.1 Summary of Field Data Collection Procedures and Sampling Activities over a 48-h Period at a Participant’s Home and/or Day Care Center

Sampling Day	Data Collection and Sampling Activity/Task
Day 1	<ul style="list-style-type: none"> < Obtain signed consent form < Conduct Pre-monitoring Interview < Complete the House/Building Characteristic Observation Survey < Provide instructions on food sample collection, give food containers and cooler, ask if it’s OK to store the food samples in the participant’s refrigerator < Remind parent and teacher--no vacuuming during the 48-hour period (sweeping with a broom is OK) < Review the instructions for collecting urine and hand wipe samples < Give the sample collection supplies to the parent and teacher (e.g., urine and hand wipe) < Review instructions for recording in the Child Activity Diary < Set up indoor air monitor, mark the location on the sketch, record air log < Set up outdoor air monitor, mark the location on the sketch, record air log < Take pictures of sampling activities. <p><i>Note: Each child’s supplies (clean sample containers) are stored in a clean container with name labeled on top).</i></p>
Day 2	<ul style="list-style-type: none"> < Complete activities pending since Day 1, if any < Check outdoor air monitor, record air log < Check with the parent and teacher for questions about or problems with sampling activities < Videotape child’s activities, if applicable
Day 3	<ul style="list-style-type: none"> < Complete activities pending since Day 1, if any < Unload indoor air samplers, record air log, remove air monitors < Collect dust sample, vacuum the house (must unload the indoor air samplers first) < Unload outdoor air samplers, record air log, remove air monitors < Collect one soil sample (children’s usual outdoor play area), mark the location on the sketch < Collect hard floor surface wipe sample < Collect food preparation surface wipe sample < Collect PUF roller sample for transferable residues < Pick up food samples, examine the samples, remove any non-edible materials < Pick up urine and hand wipe samples < Pick up the Child Activity Diary < Conduct Post-monitoring Interview < Present a <i>Certificate of Appreciation</i> to the parent and teacher < Confirm the check mailing information with the parent and teacher < Take pictures of sampling activities < Videotape child’s activities, if randomly selected

5.2.1.1 Outdoor Play Area Soil

Outdoor play area soil was sampled from the location identified by the teacher or the primary caregiver as most often used by the children. A scraping (putty) knife was used to collect the soil from the top 0.5 cm of soil in a 1 ft² (0.1 m²) area and placed into a glass jar. If a play area did not have bare soil or dirt (e.g., grass, sand), the sample was collected near a subject's sidewalk, driveway, or garden, reasonably close to the identified play area.

5.2.1.2 Indoor Floor Dust

The high-volume small surface sampler (HVS3; Cascade Stack Sampling Systems, Bend, Oregon) method was used to collect floor dust from a 0.76 m² area of carpet (12). The samples were collected in the room the child used most often at the residence or day care center. The initial sampled area was 0.76 m². Additional 0.76 m² areas of the carpet were sampled until a sufficient amount of dust was collected for analysis (typically ~1.0 g). The dust sample was transferred from the Teflon catch bottle to a glass jar. A hard floor surface wipe, described below, replaced the floor dust sample when no carpeted areas were available.

5.2.1.3 Indoor and Outdoor Air

Outdoor and indoor air was sampled over a 48-h period using filter and a backup XAD-2 trap to collect pollutants in air (8). Briefly, outdoor samples were collected using a Thomas pump (Model 107CAB18A; Thomas Compressor and Vacuum Pumps, Sheboygan, MI). Indoor samples were collected using an SKC pump (Model 224-PCXR8; SKC, Inc., Eightyfour, PA). Flow rates for both pumps were set at a range of 3.9 to 4.1 L/min using a calibrated flow meter. The inlet port of the sampling cartridge was placed approximately 75 cm above the floor or ground, at the approximate breathing height of children in the participant age group. The URG-2000 sampling cartridge (University Research Glassware Corp., Chapel Hill, NC) contained a pre-cleaned quartz fiber filter and an XAD-2 cartridge, to collect the targeted pollutants both in the vapor phase and condensed on particles < 10 µm. Outdoors, the sampling pump and controls were placed in a Styrofoam cooler, which was housed in a large, plastic doghouse, furnished by the field staff, to protect the equipment from inclement weather conditions. Indoors, the sampling equipment was placed in a Styrofoam cooler and housed in a child's playpen, also furnished by the field staff, which was covered by a stroller net to protect it from curious children or pets. Flow rates were recorded at the beginning and end of the sampling period.

5.2.1.4 Drinking Water

For the day care center component, field staff collected one drinking water sample from each participating child's home and one sample from each participating day care center. For the telephone component, only one drinking water sample was collected from each participating child's home. These samples were collected in either 1-L or 0.5-L plastic jugs and refrigerated until shipped to the laboratory.

5.2.1.5 Duplicate Plate Food and Beverages

Duplicate plate samples of the solid and liquid food served to the children (7,8) were collected for each child during the 48-h sampling period. At home, the adult caregiver provided the same amount of the same food and beverages, excluding drinking water, consumed by their child over the sampling period. The teachers provided duplicate servings of food and beverages consumed by the participating children while at day care. Because all children in a given classroom were served the same food on the same day, only one duplicate sample was provided for each classroom on a given day. If a child brought his/her food from home, the home caregiver was asked to provide a duplicate sample of that food. Composite solid and liquid food samples were collected separately in 2 L glass containers. These containers were placed in provided coolers with blue ice until they were picked up by field staff.

5.2.1.6 Dermal Hand Wipes

Adult caregivers and day care teachers collected dermal (hand) wipe samples from each participating child during the 48-h sampling period (8). Hand wipe samples were taken before the participants washed their hands. The hand wipe consisted of a gauze pad (SOF-WICK, 10 x 10 cm – 3 ply; Johnson & Johnson), which was pre-cleaned with dichloromethane (DCM), dried and wetted with 2 mL of 75% isopropanol in distilled water, and stored in a glass jar. The adult caregiver removed the pre-wetted gauze pad from the jar and wiped both hands of the child, according to a specified procedure (CTEPP-SOP-2.15), then put the wipe back into the jar. A total of four hand wipe samples were collected for each child (two per day, one each before lunch and dinner). All hand wipe samples were refrigerated or placed in provided coolers with blue ice until picked up by field staff. Adult participants collected their own dermal wipe samples according to these same procedures.

5.2.1.7 Transferable Residues

The polyurethane foam roller (PUF) method (13) was used to collect transferable residues from indoor floor surfaces (e.g., carpet, vinyl), at homes or at day care centers that had recent pesticide applications. Transferable residues were sampled at three locations where the child spent most of their time inside the home or day care center; these locations were not the same as those that were sampled for carpet dust with the HVS3. The PUF roller apparatus, having a pre-cleaned, dry PUF sampling cylinder was rolled on the indoor floor surface at a rate of approximately 10 cm/s for a 2 m distance (1 m up and back). This procedure was repeated, using the same PUF cylinder, at the other two selected locations. On completion of sample collection, the PUF cylinder was wrapped in muffled aluminum foil and placed in a Ziplock bag.

5.2.1.8 Food Preparation Surface Wipe

At homes and day care centers having recent pesticide applications, food surface preparation wipes were collected from the kitchen counters where food was prepared. The wipe consisted of a pre-cleaned, gauze pad (SOF-WICK, 10 x 10 cm – 3 ply; Johnson & Johnson), which was cleaned with DCM, dried, and then wetted with 2 mL of 75% isopropanol and stored in a glass jar. Masking tape was used to mark off a 38 x 38 cm (0.14 m²) area of the counter. The sample was collected by wiping this part of the counter in one direction, folding the wipe in half and wiping the surface again in the opposite direction, then returning it to the glass jar.

5.2.1.9 Hard Floor Surface Wipe

At homes and day care centers either having recent pesticide applications or having little or no carpeted floor surfaces for dust sampling, hard floor surface wipe samples were collected on indoor floors (i.e., tile, vinyl, hardwood floors) where the children spent most of their time. The wipe consisted of a gauze pad (SOF-WICK, 10 x 10 cm – 3 ply; Johnson & Johnson), which was cleaned with DCM, dried, and wetted with 2 mL of 75% isopropanol and stored in a glass jar. Masking tape was used to mark off a 38 x 38 cm (0.14 m²) area of the floor. The sample was collected by wiping the designated area of the floor in one direction, then folding the wipe in half, and wiping the surface again in the opposite direction, then returning the wipe to the jar.

5.2.1.10 Urine

Spot urine samples were collected from each child over the 48-h monitoring period (8). The child urinated into a plastic urine collector (bonnet) that was placed under the toilet seat. The urine was then poured into a 120 mL plastic bottle by the adult. Adult caregivers, when at home, collected three urine samples per day (first morning void, after lunch, and after dinner or before bedtime) from their child. Day care teachers collected one urine sample from the child each day after lunch. All urine samples were refrigerated or placed into provided coolers with blue ice until picked up by field staff. Adult participants collected their own urine samples at the same frequency following similar procedures. Note: The spot urine samples for adults and children were composited over the 48-h period, with the exception of those collected at homes with recent pesticide applications, which were stored and analyzed separately.

5.2.2 *Supplemental Information*

Supplemental information was collected to help assess the children's exposures to pollutants in their everyday surroundings. Table 5.2.2 summarizes the types of collected supplemental data. The same types of forms were used in both the NC and OH studies to collect these data. The recruitment survey (Form #1) was used to collect the subject's eligibility information. This form was administered either by an interviewer, using Computer Assisted Telephone Interviewing (CATI), or as a Self-Administered Questionnaire. The house/building characteristics survey described the physical characteristics of the sampled house (Form #2) and

Table 5.2.2 Types of Questionnaires, Diaries, or Menus Collected from Participants

Supplemental information	Types of information
Recruitment survey (Form #1)	Identify potential participants in a household.
House/building characteristics observation survey (Form #2)	Document the physical characteristics of the house and identify/inventory possible sources of pollutants.
Day care center/building characteristics survey (Form #3)	Document the physical characteristics of the day care center and identify and inventory possible sources of pollutants.
Parent pre-monitoring questionnaire (Form #4)	Identify the individuals living in the home and describes the sources and routes of potential exposure to pollutants.
Day care center pre-monitoring interview (Form #5)	Identify the individuals within the day care center/classroom and describe the sources and routes of potential exposure to pollutants.
Parent post-monitoring questionnaire (Form #6)	Provide information on the child's activities and potential exposure to pollutants over the 48-h sampling period.
Day care center post-monitoring questionnaire (Form #7)	Provide information on the child's activities and potential exposure to pollutants over the 48-h sampling period.
Child activity diary and food survey-home group (Forms #8/AM and #8/PM)	Provide information on the child's activity patterns and food consumption patterns at home.
Child activity diary and food survey-day care group (Forms #9 and #10)	Provide information on the child's activity patterns and food consumption patterns at day care center.
Day care center menus	Provide daily dietary menus up to three months prior to field sampling at a day care center.

day care center (Form #3) and collected information for identifying possible sources of pollutants. These forms were filled out by the field staff. Pre- and post-monitoring questionnaires (Forms #4 to #7) collected general information on the households and day care centers, as well as specific information on the possible sources of contamination in the children's surrounding environments, on the usage of pesticides, and on the children's usual activities and their activities during the 48-h sampling period. Child's activity and food diaries (Forms #8, #9, #10) documented the information on the child's activities and food consumption patterns over the 48-h sampling period. Forms #4 through #10 were filled out by teachers and home caregivers. Additionally, day care center food menus were collected; these provided information on the food served at the centers a few weeks before field sampling occurred.

5.2.3 Sample Custody, Field Storage, Shipping, Laboratory Receipt, and Laboratory Storage

The NC and OH field samples collected by participants during the 48-h sampling period (food, hand wipe, and urine) were temporarily stored in the provided cooler with ice packs or in the participant's home refrigerator until collected by the project staff at the end of the sampling period. Samples collected from NC were temporarily stored in freezers at or below -10°C at the NC field office until shipped on dry ice to the Battelle laboratory in Columbus, OH on a weekly basis. OH field samples were stored in freezers at or below -10°C in the analytical laboratories until being prepared for analysis.

Before field sampling, all sample containers were appropriately identified and labeled with their purpose and with bar codes, then checked by the QC staff at the field office. Just prior to leaving the field office for a sampling appointment, the field team conducted a sample and equipment inventory and verified all sample ID labels again. During field sampling, the field team collected samples and noted sample conditions on the field sample/data check list. After the samples were collected and brought back to the field office, they were processed immediately by the receiving team. Sample conditions and collection information were recorded into the CTEPP Tracking System. All labels were checked and samples were transported and stored in accordance with specifications described in the field sample handling SOPs (CTEPP SOPs 3.10 - 3.12 and 4.10 - 4.12).

Strict sample custody procedures were followed throughout the collection and analysis activities. A sample chain of custody form was used to document all collection, shipment, receipt, analysis, processing, and handling steps that each sample underwent as it passed from one individual to the next. This record was initiated in the field by the responsible field staff member and captured the original field collection of the sample, as well as all subsequent operations performed. Each sample custody record contained, at a minimum, the following information: participant identification code, sample ID, the operation performed on the sample (e.g., collection, processing, shipment, receipt, storage, laboratory procedure, disposal), initials of the person performing the operation, date on which the operation was initiated, and any relevant remarks or comments pertaining to the sample. The sample custody form was a hand-written paper record. In addition, a computer-based tracking system was employed, into which the scanned information from the sample bar codes, as well as other pertinent information

for all collected samples, was entered. At the laboratory, the samples were stored in freezers at or below -10°C until sample preparation and chemical analysis.

5.2.4 Quality Control

Quality Assurance/Quality Control (QA/QC) procedures (including pre-field assessment and field assessment) were implemented throughout the field data collection periods in NC and OH.

For pre-field assessment, the sampling equipment was calibrated and the sampling media were prepared in the laboratory prior to shipment to the field. Equipment was always tested when it was set up and when it was removed, to ensure that it performed to specifications defined in the relevant SOPs. All SOPs and field forms were field tested prior to project implementation. SOPs and field forms that were found to be inadequate were revised and finalized prior to field implementation.

For field assessment, field duplicates were collected for air samples. The dust, soil, food, urine, and drinking water samples were bulk samples; different aliquots of the same samples were used as field duplicates. Field blanks, which underwent the same handling and shipping procedures as real field samples but did not go through the sample collection step, were generated in the field to document any possible contamination that might have occurred in field sample handling and shipping. Field blanks were prepared and analyzed using the same methods as field samples.

Questionnaire results obtained during field visits were reviewed by technicians in the field. The final checks for completeness were performed by the QC team members at the field office.

Quality assurance orientation for CTEPP NC and OH field data team members included an overview of program and facility QA requirements, QA requirement documents, field data record keeping and quality assurance/quality control monitoring. The Battelle Quality Assurance Officer (QAO) conducted field audits in both the NC and OH field studies. Field inspections performed by the Battelle QAO included facility preparation and sample storage areas in Durham NC, as well as Day-3 sampling activities. The QAO also inspected the Battelle Columbus OH laboratory facilities for adherence to sample receipt, inspection, storage, preparation and analysis procedures and oversaw sampling preparation and set-up, Day-1 sampling, and sample preparation performed in Columbus. In addition, Battelle Field Team Leaders conducted periodic internal field audits as described in CTEPP SOP 2.25. The EPA QAO and EPA Task Order Project Officer (TOPO) also performed field audits in NC and OH. There were no non-compliance findings observed during these audits. All recommendations generated during internal and external audits, technical systems audits (TSAs) and surveillances were formally documented in laboratory internal records or in responses to EPA audit reports.

5.3 Results

Results of the NC and OH field data collection activities are summarized in Sections 5.3.1 and 5.3.2.

5.3.1 North Carolina

Tables 5.3.1 and 5.3.2 summarize the completeness associated with the collection of field samples and supplemental information (questionnaires/diaries), respectively, from NC. Field data collection activities in the NC study achieved greater than 99% completeness for field samples, 100% for collected questionnaires/diaries, and greater than 99% for data collected on the questionnaires/ diaries.

The proposed samples were the ones that the field staff or participants planned to collect at home or at day care. The collected samples were the ones that were actually collected in the field. Empty liquid food containers were collected in some households, because the adult caregivers claimed that they or the child participants drank only water. Thus, we did not count the liquid food samples from these households. Completeness of field data collection was expressed as a percentage of all samples collected in the field that had data generated in the laboratory.

Despite the fact that participants were paid (\$25) sufficiently in advance to cover their cost of duplicate food samples, some participants were still reluctant to provide us these samples. Solid food samples with the smallest weights (12.3 g of adult food and 7.76 g of child food) were collected from the same low-income household. The adult caregiver in this household claimed that they did not consume large amounts of food. Two day care centers provided only snacks and the children brought their own lunches. Since these lunches were prepared at the children's homes, the parents were asked to prepare duplicate lunches, which were provided as part of the at-home food samples. In one household, the adult participant withdrew from the study after the Day-1 sampling event because the domestic partner did not want to continue the study. Therefore, only partial field samples were collected and analyzed. However, a complete set of questionnaires/ diaries was collected from this household.

As shown in Table 5.3.2, 100 % of data forms were collected from the participating households and day care centers, and more than 99% of the data were collected from these forms. Data values labeled as "incomplete" were treated as missing data, i.e., data that participants failed to provide and/or which could not be obtained by re-contacting the participants. After all attempts were made to re-contact the participants in order to obtain missing information, the any uncollected data were coded as "Missing". Responses of "Don't Know" (as stated by the participant) or "Refused" were not treated as missing data items because these were valid responses.

Table 5.3.1 Summary of the Completeness of the NC Sample Collection

Sample Description	Proposed	Collected ^b	Reported	Samples Voided	Completeness (%)
Hand Wipe Adult	198	197 ^c	197	0	100
Hand Wipe Child	284	283 ^c	283	0	100
Drinking Water	155	155	155	0	100
Food Preparation Surface Wipe	18	18	18	0	100
Hard Floor Surface Wipe	46	46	46	0	100
Indoor Air Acid	151	151	150 ^d	1	99.3
Indoor Air Neutral	151	151	151	0	100
Floor Dust	154	154	154	0	100
Liquid Food Adult	130 ^a	123 ^c	122 ^f	1	99.2
Liquid Food Child	166 ^a	164 ^e	163 ^g	1	99.4
Outdoor Air Acid	154	154	154	0	100
Outdoor Air Neutral	154	155 ^h	154	1	99.4
Transferable Residues	18	18	18	0	100
Solid Food Adult	130	130	130	0	100
Solid Food Child	166	166	166	0	100
Outdoor Play Area Soil	143	143	143	0	100
Urine Adult	618, 190 ⁱ	615, 190 ^h	615, 190	0	100
Urine Child	744, 283 ⁱ	739, 283 ⁱ	739, 283	0	100

^a Empty jars were collected for the liquid food samples because the participants claimed they drank only water.

^b Samples collected include all field samples and field blanks but not laboratory generated QC samples.

^c The participant withdrew from the study after day-1 sampling because the domestic partner refused to participate.

^d One sample was voided due to pump malfunction (air volume sampled equaled zero).

^e Count does not include the empty jars that were collected from households in which the adult and/or child only drank water.

^f One sample was spilled during preparation.

^g The field staff dropped one liquid food sample while loading the van.

^h One extra outdoor air sample was collected to replace one sample due to pump malfunction.

ⁱ The first number is the number of individual collected urine samples, and the second number is the number of both composite and non-composite samples.

Table 5.3.2 Summary of the Completeness of the NC Questionnaire/Diary Collection

Form Number	Proposed	Collected	Reported	Completeness for Collected Forms (%)	Completeness for Collected Data^a (%)
Form # 1	130	130	130	100	99.6
Form # 2	130	130	130	100	99.8
Form # 3	13	13	13	100	99.8
Form # 4	130	130	130	100	99.9
Form # 5	13	13	13	100	99.8
Form # 6	130	130	130	100	99.3
Form # 7	63	63	63	100	99.9
Form # 8	67	67	67	100	99.0
Form # 9	63	63	63	100	99.7
Form # 10	63	63	63	100	99.6

^a A SAS program was used to calculate the percentage of completeness for the data collected on each form using the equation $\text{Completeness (\%)} = [(A-B)/A]*100$

where A = Count the total number of filled, valid data variables (not empty)

B = Count the number of data variables coded as “missing”

5.3.2 Ohio

Tables 5.3.3 and 5.3.4 summarize the completeness associated with the collection of field samples and supplemental information (questionnaires/diaries), respectively, from OH. Field data collection activities in the OH study achieved greater than 99% completeness for field samples, 100% for collected questionnaires/diaries, and greater than 94% completeness for the data collected on the questionnaires/diaries. In addition, all proposed children (26) were successfully videotaped at their homes in OH; therefore, 100% completeness was achieved for the videotaping activities.

Table 5.3.3 Summary of the Completeness of the OH Sample Collection

Sample Description	Proposed	Collected ^b	Reported	Samples Voided	Completeness (%)
Hand Wipe Adult	196	196	196	0	100
Hand Wipe Child	283	283	283	0	100
Drinking Water	157	157	157	0	100
Food Preparation Surface Wipe	16	16	16	0	100
Hard Floor Surface Wipe	38	38	38	0	100
Indoor Air Acid	150	150	150	0	100
Indoor Air Neutral	150	150	150	0	100
Floor Dust	157	157	157	0	100
Liquid Food Adult	127 ^a	122 ^c	122	0	100
Liquid Food Child	171 ^a	170 ^c	170	0	100
Outdoor Air Acid	156	156	155	1 ^d	99.4
Outdoor Air Neutral	156	156	156	0	100
Transferable Residues	18	18	18	0	100
Solid Food Adult	127	127	127	0	100
Solid Food Child	170	170	170	0	100
Outdoor Play Area Soil	143	143	143	0	100
Urine Adult	634, 194 ^e	634, 194 ^e	634, 194 ^e	0	100
Urine Child	756, 266 ^e	756, 266 ^e	756, 266 ^e	0	100

^a Empty jars were collected for the liquid food samples because the participants claimed they drank only water.

^b Samples collected include all field samples and field blanks but not laboratory generated QC samples.

^c Count does not include the empty jars that were collected from households in which the adult and/or child only drank water.

^d One sample was lost during laboratory extraction.

^e The first number is the number of individual urine samples collected, and the second number is the number of both composite and non-composite samples.

Table 5.3.4 Summary of the Completeness of the OH Questionnaire/Diary Collection

Form Number	Proposed	Collected	Reported	Completeness for Collected Forms (%)	Completeness for Collected Data^a (%)
Form # 1	127	127	127	100	98.8
Form # 2	127	127	127	100	100
Form # 3	16	16	16	100	99.8
Form # 4	127	127	127	100	99.9
Form # 5	16	16	16	100	99.4
Form # 6	127	127	127	100	99.9
Form # 7	58	58	58	100	99.6
Form # 8	69	69	69	100	99.9
Form # 9	58	58	58	100	95.1
Form # 10	58	58	58	100	94.0

^a A SAS program was used to calculate the percentage of completeness for the data collected on each form using the equation $\text{Completeness, (\%)} = (A-B)/A * 100$

where A = Count the total number of filled, valid data variables (not empty)

B = Count the number of data variables coded as “missing”

5.4 Evaluation

Several problems were encountered during field sample collection. A frequent problem encountered at the day care centers was the teachers' difficulty in recording the time-activity diary for more than one child in a classroom. Although project field staff went over the recording procedures carefully with the teachers before sampling, the detail required was overwhelming for some of them. As a result, coverage of the time periods in the child activity diaries was sometimes incomplete. In future studies, this information should be collected by a more simplified method.

Some day care teachers were reluctant to collect and store children's urine samples for later pickup. Field staff, therefore, assisted in urine sample collection at day care centers when requested. Some parents had difficulty understanding the need and procedures for duplicate plate food sample collection and the time-activity diary recording procedures. Thorough pre-sampling training of the adult participants by the field staff was necessary to communicate these procedures.

Training of day care teachers and parents was conducted at the participating day care centers in each state. The project staff first consulted with the day care director to identify the best time for the training (normally in the afternoon before the pickup time of the children). A flyer about the upcoming CTEPP study meeting was then distributed to all selected parents and classroom teachers a few days before the scheduled training date. The meeting was designed to accomplish the following: (1) training of teachers in the selected classrooms (often best accomplished when children were napping); (2) training of parents; (3) meeting with the day care cook or kitchen staff to explain food collection; and (4) meeting with the day care director to confirm sampling dates at the day care and to discuss the information needed for pre-monitoring interview (e.g., day care floor plan and chemical use information).

Training for teachers and parents included a brief study background discussion (e.g., what the study was about, why it was important, what assistance was needed from them) and a step-by-step demonstration of the procedures for completing the child activity diary and for collecting urine, hand wipe, and duplicate food samples. Best results were achieved when two to three staff members were available to train a small group of participants. The training emphasized hands-on practice. Instruction sheets were handed out to participants after training for use at home. In addition to the training, the staff also reviewed the informed consent process with the parent and asked the parent to complete the recruitment survey if informed consent had been obtained earlier. After the training was completed, a project T-shirt was presented to each participant. Finally the staff confirmed the sampling schedule with the parent and gave them a money order for \$25 to cover their cost for providing duplicate food samples. Similar training was conducted for the telephone component participants at their homes. Once a subject was determined to be eligible through the telephone screening process, an appointment was made to meet with the subject at his/her house to go over the study procedures.

Communication issues in the field were related to problems with directions, equipment malfunctions, and scheduling changes. Participants were therefore encouraged to contact the field staff by phone at any time necessary, and all field staff were provided with cellular phones to facilitate communication with the participants and other staff members.

In one household, the study was unable to collect outdoor air samples due to no available electrical outlet for the air pump. In another household, a valid indoor air sample for acid analysis could not be obtained because the air pump did not operate properly. In one household, the participant refused to continue the study after Day-1, resulting in incomplete sets of dermal hand wipes and the child liquid food sample. The urine samples from three households were combined incorrectly by the laboratory staff, requiring the collection and processing of make-up urine samples from these households. One liquid food sample was dropped while field staff were loading the van.

5.5 Recommendations

Despite efforts to enhance participant cooperation in collecting food samples (i.e., training and pre-paying for food samples provided by the participants), there were still some missing food samples due to participants' reluctance to collect duplicate food samples. This was particularly problematic when the participants ate in a restaurant. In some situations, the project staff was able to purchase the missing food samples from the same restaurant. We recommend an increase in participant compensation or a decrease in the participant burden (i.e., collecting 24-h instead of 48-h food samples) to improve the participants' cooperation in future studies.

Some air sampling problems were caused by severe storms or an unreliable power supply at the sampling site. For future similar studies, we recommend self-powered (i.e., battery-powered) air pumps for air sampling. A battery backup system is also a good alternative; however, such systems can only provide temporary power for approximately 18 h.