

The Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP) Study

Collection of Dislodgeable Residues – PUF Roller Samples for Persistent Organic Pollutants

Battelle
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Standard Operating Procedure

CTEPP-SOP-2.18

Title: Collection of Dislodgeable Residues – PUF Roller Samples for Persistent Organic Pollutants

Source: Battelle

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

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STANDARD OPERATING PROCEDURE (SOP)
FOR THE COLLECTION OF DISLODGEABLE RESIDUES – PUF ROLLER
SAMPLES FOR PERSISTENT ORGANIC POLLUTANTS

Prepared by: _____ Date: _____

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1.0 Scope and Applicability

This standard operating procedure (SOP) describes the method for collecting transferable residues using a polyurethane foam (PUF) roller for the measurement of persistent organic pollutants (POP).

2.0 Summary of Method

This SOP describes a procedure to collect transferable residues from indoor floor surfaces. The sampling procedures described are applicable to bare floors or covered floor surfaces, e.g., carpeting and vinyl flooring. The samples will be collected only in the day care centers or households that have had pesticide applications indoors or outdoors in the seven days prior to field monitoring or during the 48-hour sampling period.

3.0 Definition

- 3.1 Transferable residue: that part of the residue of a chemical deposited on a solid surface which may be transferred by direct contact to human skin or clothing.
- 3.2 Sampling traverse: the distance from the starting point to the end point over which the sampling media contacts the floor surface for collection of a single sample.
- 3.3 PUF: polyether-type polyurethane foam

4.0 Cautions

Field staff will keep the sampling materials and the samples out of the reach of children.

5.0 Responsibilities

- 5.1 The PUF materials will be purchased by Battelle Columbus Laboratory in Ohio (OH). The pre-cleaning of the PUFs and packaging for field use will be performed at Battelle Columbus Laboratory. The cleaned PUFs will be wrapped with muffled aluminum foil, placed in a Ziploc bags and shipped to Battelle Durham Office in the North Carolina (NC) field study. The sampling and return shipping will be handled by field team members. Subsequent extractions, sample preparation, and analyses will be performed at Battelle Columbus Laboratory.
- 5.2 The Laboratory Team Leader (LTL) and Field Team Leader (FTL) will oversee the pre-cleaning of the PUF and field collection operations, respectively.

6.0 Apparatus and Materials

6.1 Apparatus

6.1.1 The PUF Roller Sampler, (as shown in Figure 1) is constructed by a machinist using primarily aluminum materials. The typical apparatus consists of a frame (12.4-cm × 25.4-cm) that is attached to a rear axle that holds a swivel joint in the center for attaching the handle and has two aluminum wheels (2.5-cm wide × 10.2-cm diameter). The distance between the outside of the two wheels is 21.6 cm and between the inside of the wheels is 16.5 cm. An aluminum cylinder (7.6-cm long × 4.3-cm diameter) is attached to the front of the sampler frame by 6-mm diameter hex head axle bolts on the cylinder that fit into slots on the frame. This cylinder serves as the front axle and also holds the PUF sampling medium (see 6.1.2). The front axle cylinder is secured in the slots by spring steel retaining clips that permit easy attachment and removal of the cylinder. The handle for the sampler is two pieces that screw together (102-cm long × 1.3-cm diameter, overall) and then screw into the swivel joint on the rear axle. Two stainless steel blocks, each measuring 12.7-cm × 7.3-cm × 2.5-cm and having a combined weight of 3.88 kg, are attached to the center of the frame through holes that fit over 3-mm diameter threaded posts on either side of the frame. The weights are secured to the frame with hand-tightened knurled nuts.

6.1.2 PUF Sampling Medium: The sampling medium consists of an annular plug cut from a sheet of medium density (0.029 g/cm³) open-cell, polyether-type polyurethane foam, 7.6 cm in thickness.

6.2 Materials

6.2.1 Tongs; scissor type, stainless steel tongs

6.2.2 Disposable latex gloves

6.2.3 Squeeze bottles

6.2.4 Stopwatch

6.2.5 Ziploc bags

6.2.3 Teflon tape

6.2.4 Bubble wrap

6.2.5 Cotton gloves

6.2.6 Aluminum foil

6.2.7 Beakers

6.3 Reagents

6.3.1 Acetone, pesticide quality

6.3.2 n-Hexane, pesticide quality

6.3.2 Diethyl ether, analytical reagent grade, preserved with 2% ethanol

6.3.3 Isopropanol, pesticide quality

6.3.4 Distilled water.

7.0 Procedures

7.1 Pre-cleaning of the PUF

7.1.1 Extract the rings with acetone in a Soxhlet extractor for 24 hr at four to six cycles/hr, followed by a second extraction with 5% diethyl ether in hexane for an additional 14 to 24 hr at four to six cycles/hr. A final 24-hr extraction with acetone is recommended to assure that the PUF ring retains its shape. Alternatively, a PUF ring can be placed in a clean beaker or a clean Ziploc bag and compressed and rinsed with the above solvents 10 times each.

7.1.2 Upon completion of the Soxhlet extractions or compressing/rinsing, transfer the PUF ring with solvent-rinsed tweezers into an open, pre-cleaned container.

7.1.3 Place containers with PUF rings inside a vacuum drying oven and dry for 16 hr under purified zero grade nitrogen.

7.1.4 Wrap the dried rings with muffled aluminum foil and place them in Ziploc bags for storage, preferably in an area protected from prolonged exposure to light.

7.1.5 Place three bar code labels on each container and wrap the container with bubble wrap for shipment to the field. The bar code labels will be generated following CTEPP-SOP-4.11.

7.2 Sampling Layout

7.2.1 Three locations where the children spend most of their time indoors will be sampled. Three sample areas where the children spend most of their time will be pointed out by the teachers (at day care center) or adult participants (at households).

7.2.2 Identify each of the three sampling area and mark the beginning and end of the 1.0 m sampling traverse with tape, chalk mark, guide bar, or another suitable visual indicator.

7.2.3 Rinse the top surface of the aluminum starting platform thoroughly with isopropanol, and allow to air dry. Place the clean platform lengthwise outside the sampling area with the edge of the shorter (25.4 cm) side aligned with the starting point of the sampling traverse.

7.2.4 After the sampling area has been defined, assemble all necessary sampling equipment and supplies and proceed to setup the sampler.

7.3 Sampler Setup

7.3.1 Place the sampler on a clean working surface. With the handle laid down horizontally on the surface, raise the roller end (front) of the sampler and rotate the entire frame assembly upwards and back until the edge of the stainless steel block weight rests against the sampler handle. The aluminum axle cylinder that holds the PUF sampling medium should be readily accessible in this position (see Figure 1).

7.3.2 Remove the front axle cylinder from the sampler frame by simultaneously grasping each hex head axle bolt, and while pushing against the spring steel retaining clips, move the cylinder out of the slots in the frame arms and forward until it is clear of the retaining clips.

7.3.3 Rinse the axle cylinder with isopropanol and allow it to air dry. Wear a pair of clean cotton gloves and remove a clean PUF ring from a plastic bag. Unwrap the aluminum foil and place it in a smooth surface. Place the PUF ring on the muffled aluminum foil with the core of the ring facing upward. Hold the axle cylinder by one of the hex head axle bolts and slide the cylinder into the center of the PUF ring.

7.3.4 Push the axle cylinder as far as possible into the PUF ring and make sure that the PUF ring is properly positioned.

7.3.5 Using the fingers of both gloved hands, grasp each of the axle bolts and twirl the cylinder in order to visually ascertain whether the PUF ring is properly centered on the cylinder. Adjust the position of the PUF ring if necessary. When the installation is complete, snap the cylinder back into place on the sampler using the reverse of the procedure used for its removal while taking care not to contact the sampling media with the sampler components or any foreign objects that might pose a source of contamination. When the sampler setup procedure has been successfully completed, proceed to collect the sample.

7.4 Sample Collection

7.4.1 Place the sampler on the aluminum starting platform with the PUF ring resting on the aluminum surface and centered near the beginning of the 1.0 m long sampling area.

7.4.2 Start the sample collection by pushing the sampler off the aluminum starting platform. Once the PUF ring contacts the floor surface, immediately begin pushing the roller at a constant rate of speed to the end of the 1.0 meter distance using the guide bar or ruler

marks to achieve a rate of approximately 10 cm/s. The operator should take care to avoid stepping on the area selected for the sample traverse both before and during the sampling operation.

- 7.4.3 When the sampler has reached the end of the traverse distance, immediately begin to pull the sampler backwards, maintaining the same 10 cm/s rate, until the same sampling area has been covered in the reverse direction with the sampler ending at the original starting point of the traverse. Use a stopwatch to time the sampling traverse operation and record the total time taken to complete the sampling.
- 7.4.4 Repeat the sampling at the remaining two designated locations following the procedures in steps 7.4.1 to 7.4.3.
- 7.4.5 Upon reaching the original starting point, immediately lift the front of the sampler upwards to remove the PUF ring from the floor surface. The frame assembly may then be rotated backwards on the rear axle until the stainless steel block weight rests against the handle.
- 7.4.6 Immediately lift the PUF roller assembly from the floor surface and move it to a non-contaminated area.
- 7.4.7 Remove the PUF ring from the axle cylinder; wrap with muffled aluminum foil; place it in its original Ziploc bag; and label the bag appropriately.

7.5 Sample Storage

- 7.5.1 After collection, samples will be stored at 4°C or below for shipping to the laboratory. Then the PUF samples will be stored in a freezer at $\leq -10^{\circ}\text{C}$ in the laboratory until extraction is performed.

8.0 Records

- 8.1 Chain-of-Custody Records will be used to document the PUF sample collection and shipping.

9.0 Quality Control and Quality Assurance

- 9.1 For each batch of the PUF that are cleaned, a blank PUF will be analyzed for the determination of the background levels of the target compounds.
- 9.2 One field blank will be prepared for each batch of the cleaned PUF. The PUF will be placed in the clean jar and labeled as a field blank. Store and ship as per instructions for actual samples.

10.0 Reference

- 10.1 Hsu, J.P., Camann, D.E., Schattenberg, H.J., Wheeler, H.G., Villalobos, K.M., Quarderer, S., and Lewis, R.G., "New Dermal Exposure Sampling Technique," in Measurement of Toxic and Related Air Pollutants: Proceedings of the U.S. EPA/A&WMA International Symposium, Publication No. VIP-17, Air & Waste Management Association, Pittsburg, 1990, pp. 489-497.
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- 10.3 Fortune, C.R., "Round-Robin Testing of Methods for Collecting Dislodgeable Residues from Carpets," U.S. Environmental Protection Agency Report No. EPA/600/R-97/119, Research Triangle Park, NC, 1997.
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- 10.5 Hsu, J.P., Wheeler, H.G. Jr., Camann, D.E., Schattenberg, H.J. III, Lewis, R.G., and Bond, A.E., "Analytical Methods for Detection of Nonoccupational Exposure to Pesticides," Journal of Chromatographic Science, Vol. 26, 1988, pp. 181-189.

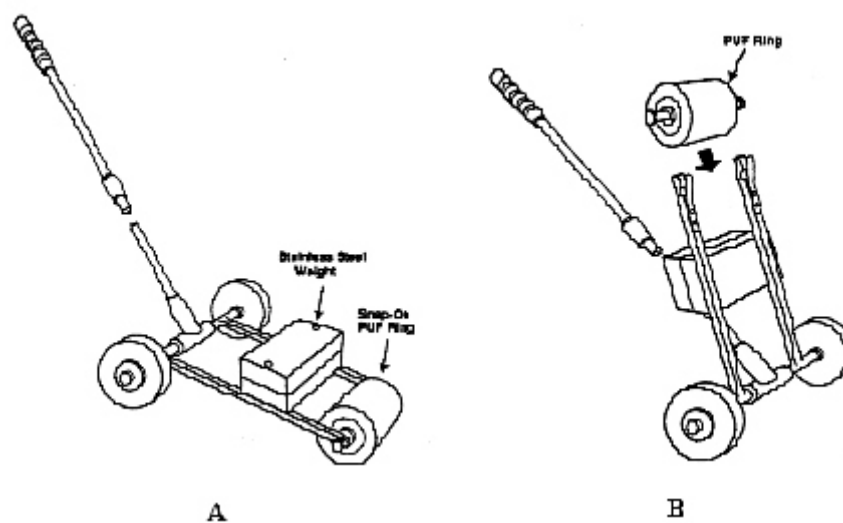


Figure 1. PUF Roller: A. In position for sampling. B. Axle cylinder/frame assembly.