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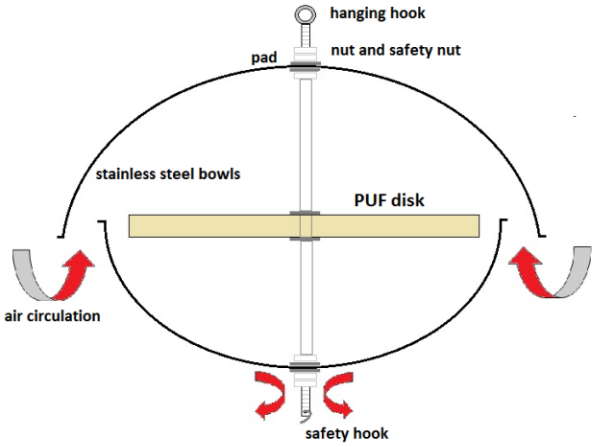
Methodology of passive air sampling



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Contents

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https://www.recetox.muni.cz/en/services/recetox-laboratories/environmental-monitoring-networks

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1. Sampler characterization

Passive air sampler consists of two stainless steel bowls attached to the common axes to form a protective chamber for the polyurethane foam disk (PUF disk). The disk is attached to the same rod and it is sheltered against the wet and dry atmospheric deposition, wind and UV light. The air flux is stabilized by the PUF disk positioning as well. The sampling period depends on type and concentration level of measured pollutants, it´s usually from 4 to 12 weeks.

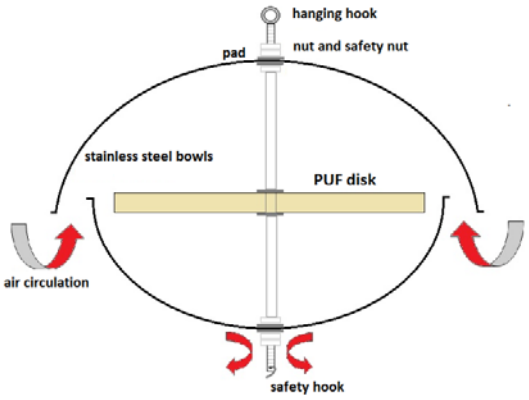
PUF disks are made from non-colored foam with defined thickness (1,5 cm) and diameter (15 cm), and small hole in the middle. All disks are cleaned in Soxhlet extractors in set of solvents chosen according to the group of pollutants that is targeted for sampling.

PUF disk extracted in acetone and dichloromethane (DCM) is appropriate for the analyses of organochlorinated pesticides (OCPs), polychlorinated biphenyls (PCPs) and polybrominated diphenyl ethers (PBDEs).

PUF disk extracted in acetone and toluene is appropriate for the analyses of polychlorinated dibenzo-p-dioxins (PCDD), dibenzofurans (PCDD/Fs) and dioxins-like PCBs.

Finally, PUF disk extracted in acetone and methanol is aimed at capturing perflourinated compounds and its precursors (PFCs).

Each disk with the metal insert is wrapped in two layers of aluminium foil. The date of cleaning and type of cleaning (solvents like DCM, toluene or methanol) are noted on the package. The labeled wrapped PUF disks are placed in a zip-lock polyethylene bag, excess air is removed and bag is closed. Clean disks are stored in a freezer at -18°C prior to deployment.



Scheme of the passive air sampler with PUF disk.

The assembly order of passive air sampler is (from top to bottom):

- Hanging hook – to hang the sampler
- Nut and safety nut – to fix the upper bowl
- Pad
- Upper bowl with diameter 30 cm placed upside down – protection of PUF disk
- Pad
- Nut – to fasten the upper bowl
- Distance tube (longer one) – to fix PUF disk in proper position below upper bowl
- Pad
- PUF disk with stainless steel insert (clean disk is prepared in the lab)
- Pad
- Distance tube (shorter one) – to fix the PUF disk position above lower bowl
- Nut – to fix the distance tube before the lower bowl mounting
- Pad
- Lower bowl with diameter 24 cm placed bottom down – condensed water can drain through four holes in the bottom of the bowl
- Pad
- Nut and safety nut – to fix the lower bowl position
- Safety hook – it protects the sampler against the falling apart due to vibrations caused by the strong wind, simultaneously enables to stabilize the sampler in a vertical position.

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2. Sampler deployment – site selection

Passive air sampler is only hanged in vertical position with the bigger bowl up and placed ideally in the man breathing zone 1,5 – 2 m above the ground (preferably grass). The metal construction is commonly used for the sampler installation and open terrain location without significant obstacles for free air stream around the sampler is optimal. Sampler should be installed on a background station which is not affected by the direct sources of air pollution. Do not install the sampler close to the fire place, chimney or outlet and outflow of measured pollutants. To prevent damage or sampler loss a secured place is required.

Passive air sampler deployment.

The sampling site may be located centrally so as to obtain information on time trends of regional sources. The site should avoid individual and large sources of pollutants so that they reflect a large area around the site and not emissions from just a few local point sources. Requirements for such a site also include geographic considerations and appropriately use already existing meteorological station. Site description should follow a standardized approach and should be documented in a sampling protocol (see chapter 3).

3. Installation and changing of PUF disk

All sampling material is prepared before passive air sampler installation. There is a list of material which is needed for PUF disk installation:

- Passive air sampler – two bowls (one big and one small bowl), one threaded rod, six nuts, six pads, two distance tubes (one big and one small tube), one safety hook **[provided]**
- PUF disk **[provided]**
- Sampling protocol **[provided]** and pen
- Open-end or ring spanner (17 mm)
- Cooler box
- Wash bottle with ethanol (alternatively hexane, acetone or isopropanol)
- Paper tissue
- Permanent marker
- Aluminium foil
- Disposable examination nitrile gloves (alternatively latex gloves)
- Manual – Methodology of passive air sampling **[provided]**.

Sampling material preparation

It is necessary to locate the sampling site with GPS coordinates (latitude and longitude) and altitude as well as to take the pictures of sampler location during the first sampler installation. It is useful for the sampler deployment to prepare the metal construction, binding wire or rope for before the first installation.

The installation and PUF disk changing is only made with **gloves** according to the procedure below.

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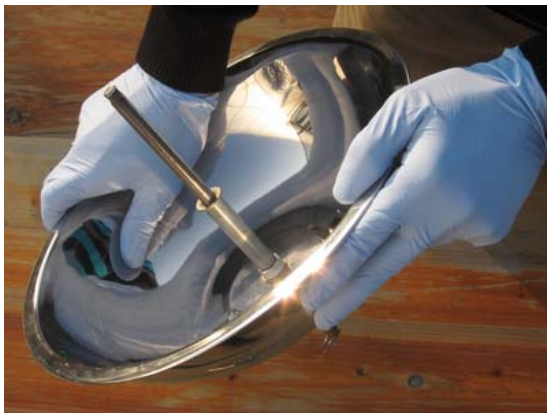
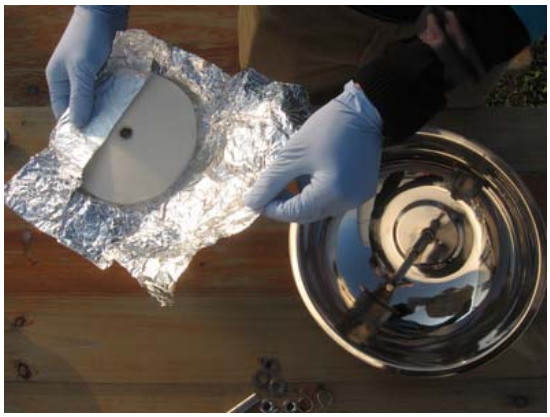
3.1.PUF disk installation

1. The upper part mounting:
- two nuts are screwed on the top of threaded rod,
- pad, upper bowl and pad are put on the rod,
- upper bowl is fasten with nut (to tighten use the spanner).

2. Put the longer distance tube and pad on the rod.



3. Remove the non-exposed PUF disk from cooler box, unpack from polyethylene bag and two layers of aluminium foil.



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4. The unpacked PUF disk with metal tube insert is put on the rod using aluminium foil, see picture below.

5. Put the pad and shorter distance tube on the rod.

6. PUF disk is fixed with nut (to tighten use the spanner).

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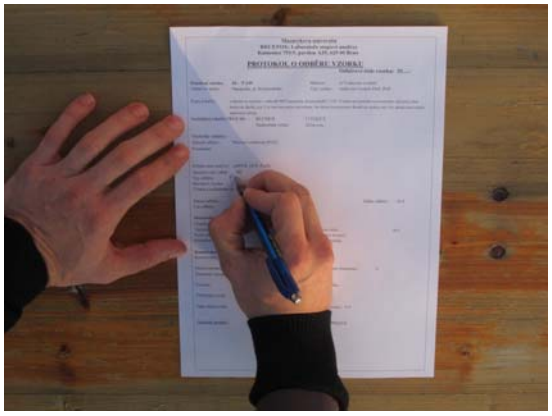
7. Put the pad, lower bowl and pad on the rod.

8. Two nuts are used for the fixing of lower bowl in proper position (to tighten use the spanner).

9. Finally insert the safety hook to the small hole in the rod.

10. Place the passive air sampler with PUF disk on the prepared metal construction. Use the hook on the top of the sampler and mount the sampler on the construction with a climbing carabine, wire or rope. If there is no metal construction, use the wire or rope and fix the sampler on an unobstructed tree branch about two meters above ground.

11. All sampling data must be written in the sampling protocol – write the sample code, start of sampling, site description, GPS coordinates, weather conditions and possible sampling influences.



3.2.PUF disk changing

Passive samplers should remains in the field for 3 months (84 days). Exposed PUF disks are removed by reversing the installation steps.

12. Detach the passive air sampler from the metal construction.
13. Remove the safety hook, nut, safety nut and pad starting from bottom.
14. Carefully remove the lower bowl without contact with PUF disk.
15. Remove the pad and nut fixing the distance tube.

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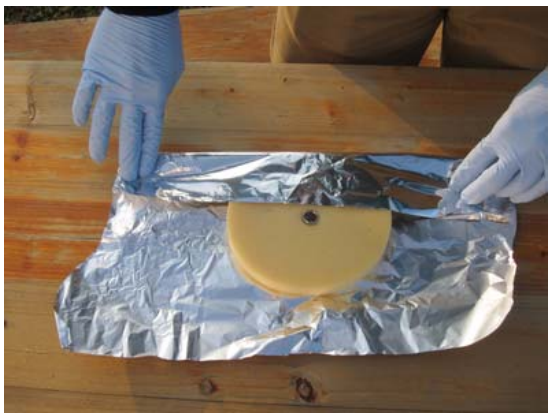
16. Carefully remove the shorter distance tube and the pad next to PUF disk.

17. Using aluminium foil remove PUF disk together with metal insert from the rod.

18. Wrap PUF disk into two layers of aluminium foil.



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19. PUF disk must be labeled using the permanent marker with the sampling code according to annex 1.

20. Place PUF disk into polyethylene bag (zip-lock), push out the air from bag and close it.

21. Exposed PUF disk is transported using the cooler box to the storage place.

22. Write all data including the end of sampling to the sampling protocol.

23. It is necessary to check the passive air sampler before new PUF disk installation. Clean the sampler with ethanol and paper tissue.

24. The installation of non-exposed PUF disk must be realized according to the procedure which is described in steps from 3 to 11.

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4. Transport and storage of PUF disk

All exposed PUF disks are transported to the storage place and stored in a freezer at -18°C until the shipment or analyses of targeted analytes. The shipment of PUF disks is organized according to the appended table. There is an information about number and type of samples, their coding and responsible laboratory.