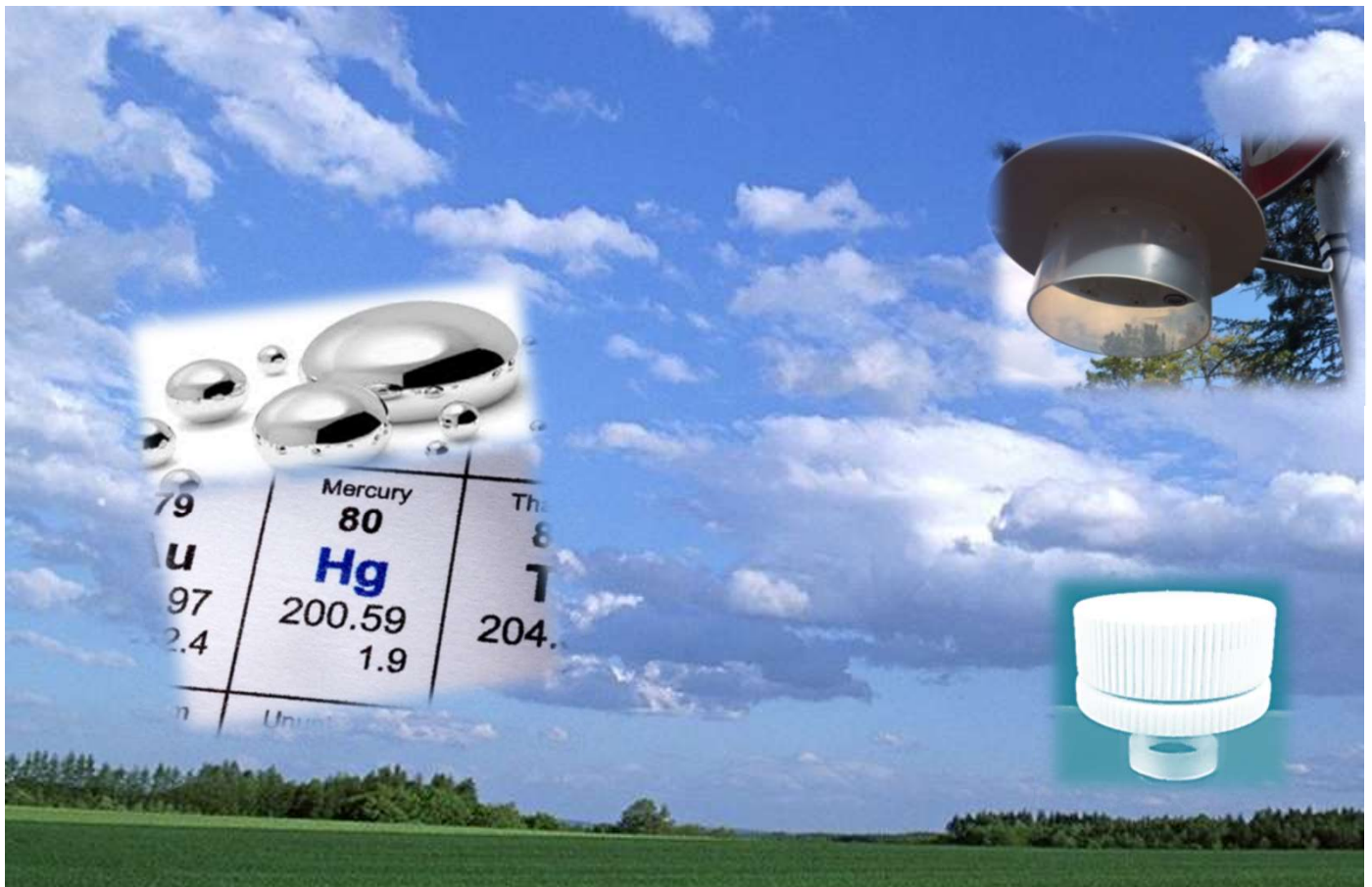




CNR - Consiglio Nazionale delle Ricerche  
Istituto sull'inquinamento Atmosferico



# Practical instructions to use CNR-IIA Passive Air Samplers (PASs) for Total Gaseous Mercury (TGM) monitoring



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## CNR-IIA PASs description

Each Passive Sampler is a **compact device** capable of binding and keeps Total Gaseous Mercury (TGM) by a simple exposure to air (indoor and outdoor).

After each environmental exposure, PAS offers indication of **average pollution values over time periods** of a few hours to weeks/months.

It works exploiting the unassisted axial diffusion process of the mercury vapour through the diffusive membrane, along the glass vessel (diffusion path) up to the adsorbing film placed on the vessel bottom. Generally, planar or axial PASs are affected by lower sampling rates and limited sampling capacity, therefore they can be both useless in short-term analysis (due to low sampling rates) as long-term sampling (analyte back-diffusion due to low capacity).

The **uniqueness** of the CNR-IIA PAS adsorbing nanostructured film and composition overcomes these issues, allowing the PAS to work properly in short- as long-term analyses.

Further the new patented **double cap system** minimizes the operator handling, thus decreasing the chance to contaminate or ruin the sample, affecting the final results.

After thermal desorption, each PAS can be **re-used** for further exposure to air, obviously only when the adsorbing layer doesn't look evidently damaged (cracked, discoloured, detached parts).

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Each PAS adsorbing film is currently **produced by hand** in the CNR-IIA laboratory (Monterotondo, Rome, Italy), and it is the result of an advanced research within UNEP-GEF Project, focussed on designing robust and effective, as well as low cost and user friendly monitoring systems.

Each PAS is housed inside a **heat- and zip-sealed** aluminum sachet **together with a home-made cartridge that has to be always kept inside the sachet (closed) before, during and after the PAS exposure.** Basically, the white cartridge must never be kept out of the sachet and must return to the analysis laboratory together with the associated PAS.

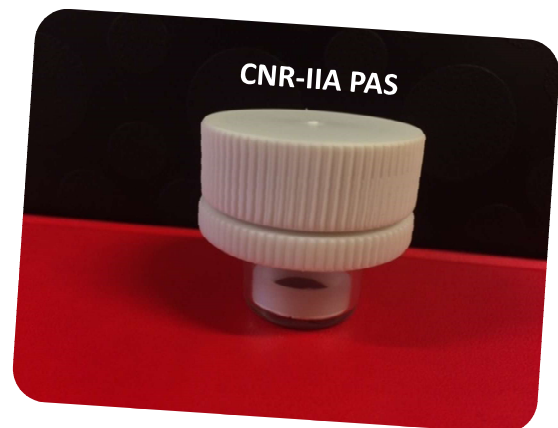
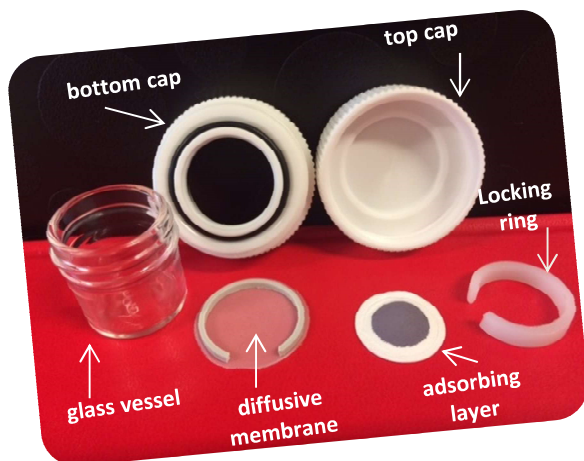
For the environmental exposure, a suitable shelter housing up to 8 seats has been also designed and developed by CNR-IIA laboratories. The circular top structure protects the samples from solar irradiation as well as the bell around the samples protects them from wind and rain, favouring their proper functioning.

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CNR-IIA Passive sampler comprises:

- ✓ a see-through borosilicate vessel (2.7 cm x 2.4 cm, height x diameter);
- a white double cap with double screwing (upper cap: 4.1 cm x 1.4 cm; bottom cap : 4.1 cm x 1.7 cm);
- ✓ a nylon membrane for gas diffusion;
- ✓ two black O-rings (I.D.: 2.2 cm);
- ✓ a grey locking ring to keep the diffusion membrane to the cap;
- ✓ a white or black locking ring to keep the adsorbing membrane to the vessel bottom;
- ✓ the adsorbing membrane (violet);
- ✓ handmade perforated and hollowed cartridge (*scrubber-like*) to reduce the sachet pollution (*to be left inside the aluminum sachet*);
- ✓ a heat- and zip-sealed aluminum sachet
- ✓ a customized IIA-shelter hosting up to N.8 CNR-IIA PAS

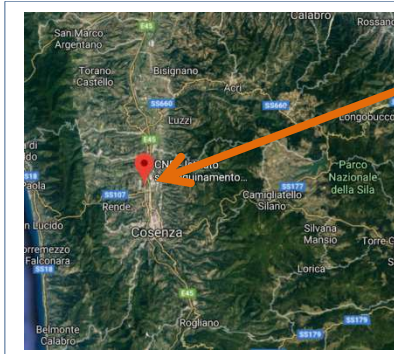


# PRELIMINARY PROCEDURES TO THE PAS EXPOSURE



## Key operating procedures

- 1) Select the monitoring site station and plan your monitoring program

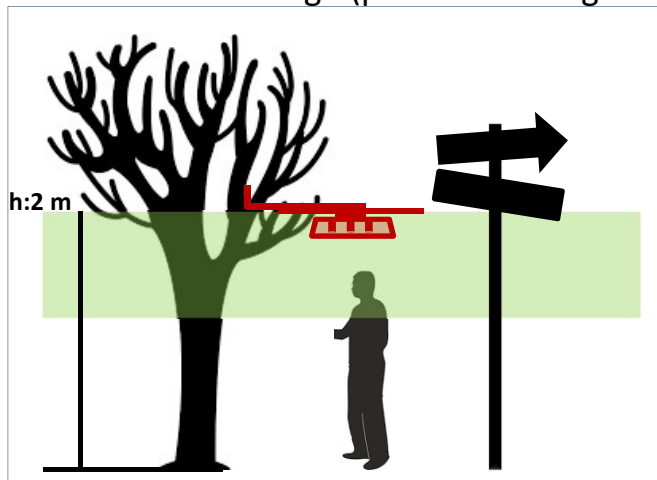


The monitoring site should be selected and latitude and longitude indicated (e.g. CNR-IIA, Rende Italy : Lat. 39°.33'; Lon. 16°.18')

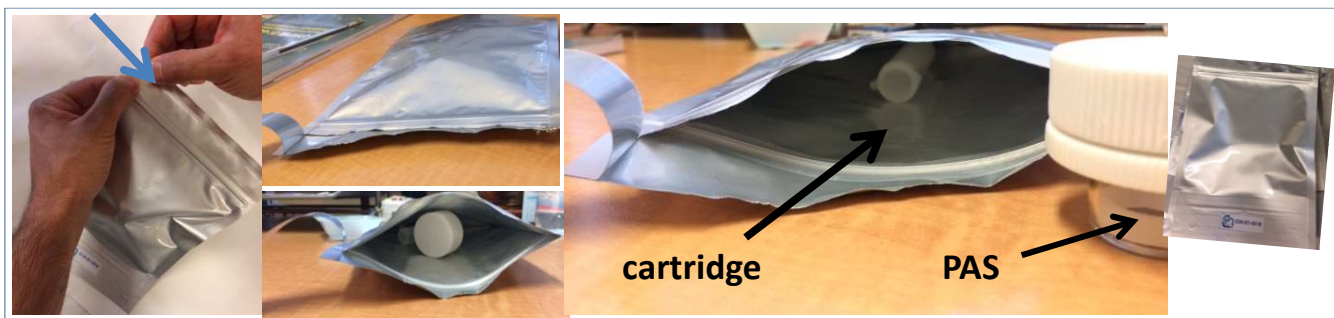
Each site should be examined and possibly photographed as well as the climatic factors that characterize it over the monitoring period (temperature, humidity percentage, rainfall, wind, etc.) should be reported



- 2) Use two hose clamps to fix the CNR-IIA-shelter to a tree or a pole about 1.80 and 2 meters high (parallel to the ground) (*the breathing zone*)



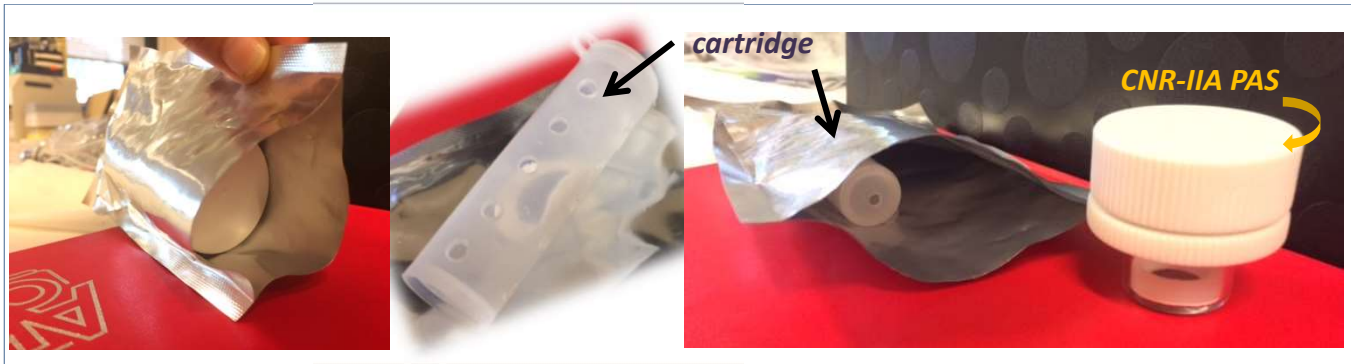
- 3) Open by hands the heat- and zip-sealed aluminum sachet and take only PAS (leave the cartridge inside the sachet). Zip-close the sachet.



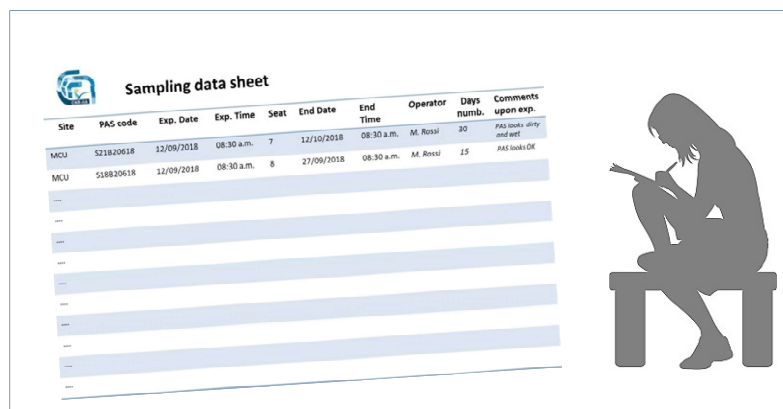
# PRELIMINARY PROCEDURES TO THE PAS EXPOSURE



4) **Reminder: pick up only the PAS leaving the cartridge inside the sachet**



5) Fill in the sampling data sheet by entering the PAS code, date, location, shelter seat, number of exposure days and any kind of comments (upon the PAS exposure) related to the state of the sample, harsh environmental conditions, etc.



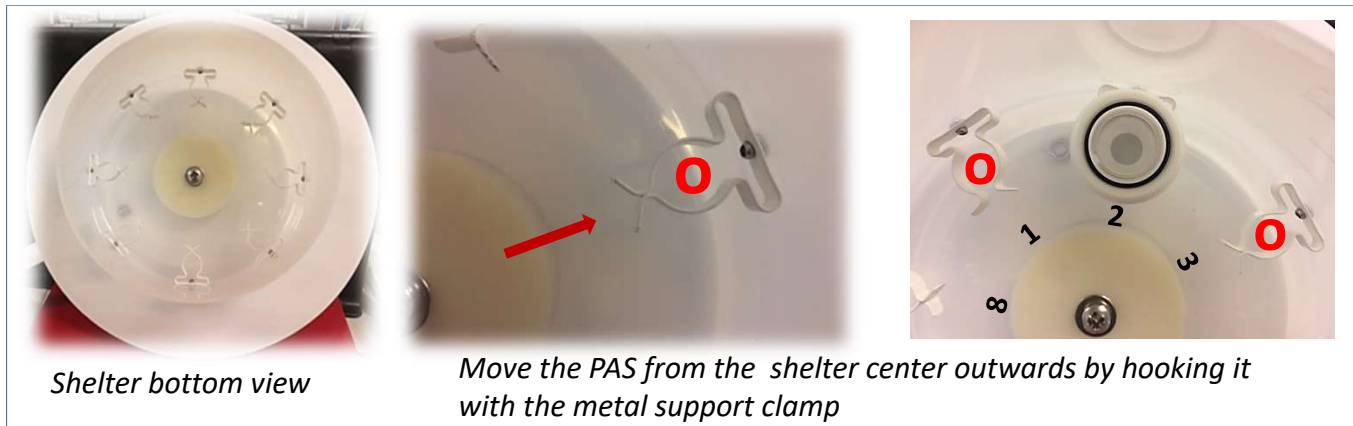
6) Unscrew counter clockwise the upper white cap (top cap)



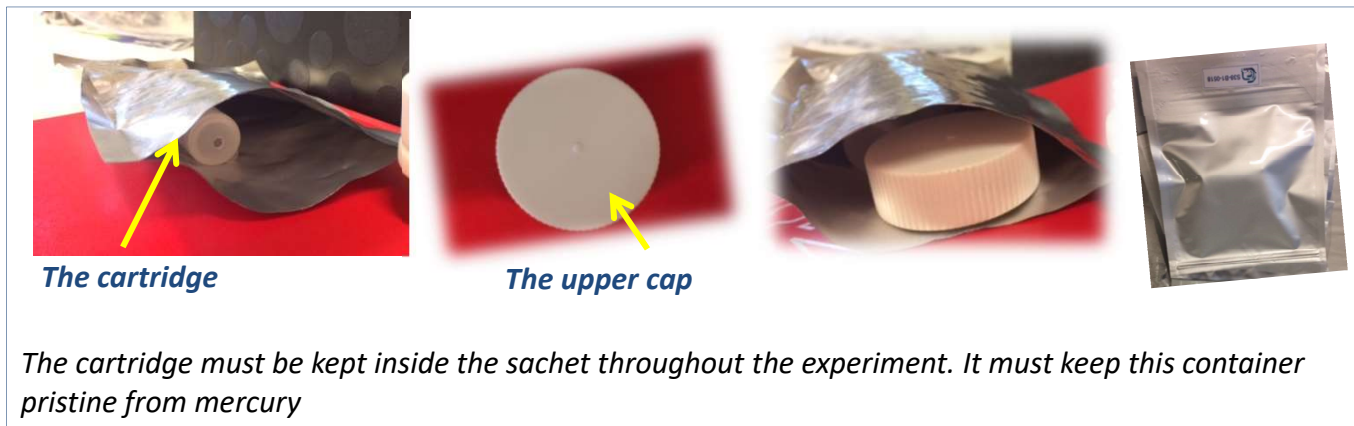
# PAS EXPOSURE



7) Place the sample coupled to one of the eight suitable locations. Each PAS must have the diffusing membrane facing downwards and the vessel bottom touching the shelter

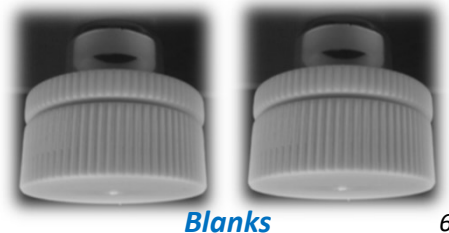


8) Put the cap back in its aluminum bag and close carefully the sachet



9) In order to remind you where each PAS has been housed, each seat has been signed with an indelible marker.

10) It is mandatory to use a couple of PASs as **BLANKs**, that is, they must **never be opened but exposed with the screwed top cap** in the first day of monitoring. Upon the end of monitoring they have to be put in their aluminum sachets (containing the cartridge) and closed. Therefore fill in the form specifying that these PASs have been treated as Blanks.





# COLLECTION AND STORAGE OF THE CNR-IIA PAS



## Key operating procedures

- ✓ Select the PAS and remove it from its seat pulling it gently down



- ✓ Open the aluminum sachet having the same sample code, pick up the cap from the aluminum sachet and screw clockwise until it stops
- ✓ Put the PAS back in the aluminum sachet and zip-close
- ✓ Report in the sampling data sheet the retired sample code, location, time, date and number of days of exposure. You could add any kind of comments related to PAS conditions upon collection (e.g. wet, dirty, sandy, frozen, broken diffusive membrane, fine, OK, etc.).
- ✓ Each PAS has to be stored preferentially in cool, dark and dry places, and far from sources of mercury, until the shipping day for analysis and **the aluminum sachet must not be zip-opened anymore.**

