

Cumulative indoor exposures to Semi-Volatile Organic Compounds (SVOCs) in France: the ECOS project



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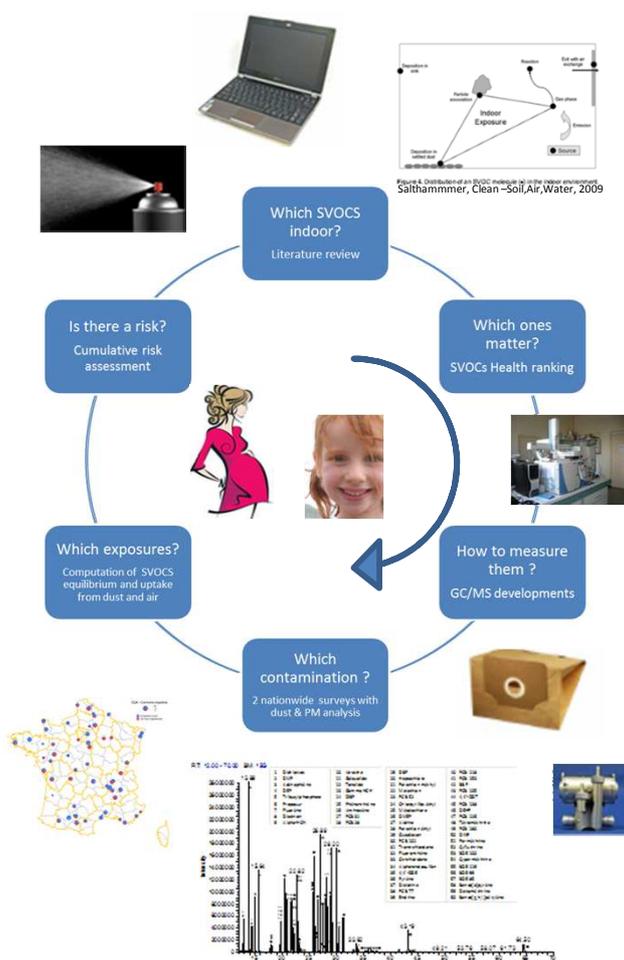
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Background & objectives

Semi Volatile Organic Compounds (SVOCs) are widely used indoor as plasticizers, flame retardants, or pesticides (Mercier F. et al. Env. Sci. Tech. 2011). They are present both in the air (in gas phase and suspended particles) and settled dust of indoor environments, thus resulting in a prevalent exposure of the population. Many SVOCs are suspected to have endocrine disrupting properties. The corresponding potential public health threat is not assessed so far. The ECOS project aims to assess domestic cumulative exposure to these substances and associated health risks.

Material & methods



Selection of compounds.

Among 254 SVOCs potentially present indoors, 66 could be ranked on the basis of their toxicity and indoor dust concentration (Bonvallot N. et al. Indoor Air. 2010). Many are likely to be toxic for reproduction or development, most of them by endocrine disruption. 55 can be analyzed together by gas chromatography (GC) coupled to mass spectrometry (MS) : polycyclic aromatic hydrocarbons, polychlorobiphenyls, polybromodiphenylethers, phthalates, pesticides and musks.

Analytical methods development.

Methods have been specifically developed from this list.

Analytes from dust samples are extracted by pressurized liquid extraction and analyzed by GC coupled with tandem mass spectrometer (GC/MS/MS). Suspended particulate matter is analyzed by thermodesorption coupled with GC/MS (Mercier F. et al., Journal of Chromatography A 2012).

Samples collection and analyses.

Analyses from nationwide campaigns will provide, after statistical adjustment, French PM and settled dust contamination with SVOCs.

Particular matter (PM₁₀) (N=297) filters collected in a national survey representative of French dwellings (Indoor Air Quality Observatory, 2003-2005) will be analyzed in 2013 by TD/GC/MS/MS. 145 vacuumed settled dust samples collected during another national survey (Plomb-Habitat, 2008-2009) representative of young children's dwellings were analyzed in 2012 by GC/MS/MS. In addition, samples have also been collected in 30 French schools (Le Bot B. et al., PNRPE 2012).

Gas-phase concentration modeling.

Partitioning of SVOCs among the settled dust, airborne particles and gas phase in 30 French dwellings (Blanchard B. et al. PNRPE 2012) will be used to estimate the gas phase concentration from either measured PM10 or dust concentrations.

Exposure assessment

Indoor exposure will be assessed by adding inhalation (SVOCs in gas-phase and PM), ingestion route (SVOCs in settled dust) and possibly dermal route for children and adults.

Cumulative risk assessment. Pollutants with similar mechanisms of action have been grouped by reproductive, neurotoxic and immunotoxic modes of action. Specific corresponding toxicity reference values will be derived with the point of departure index and relative potency factors approaches. (Fournier F. et al. PNRPE 2012). They will allow assessing risks of indoor exposures.

First results & perspectives

SVOCs have been health ranked and grouped by reproductive, neurotoxic and immunotoxic modes of action. A specific multiresidue GC/MS/MS method has been developed. Nationwide dust and PM samples have been collected and are currently analyzed. Next expected results are an equilibrium model between dust and air ; SVOCs contamination (dust and air) and exposure in French dwellings; and finally a cumulative health risk due to indoor exposures.

Assessing cumulative risks due to indoor SVOCs may help targeting prevention measures by identifying compounds, and exposure media that leads to a greater risk.

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