

# Population Exposure to PAH EXPAH



EXPAH ENV/IT/000082

January 2012, Issue 1

## Welcome to 1<sup>st</sup> issue of the Newsletter

### 1. Editorial

The EXPAH partners are pleased to present the first issue of the EXPAH project Newsletter.

The purposes of the newsletters are to inform about activities, progress, and achievements of the EXPAH project, to establish a communication link between end-user and partners, as well as with the Collaborators, and Stakeholders Community, to monitor the project activities and to exchange input and experiences. For these reasons your contributions to newsletters and news at the web-site as well as comments are always welcome (send to [expah@asplazio.it](mailto:expah@asplazio.it)).

In this number a brief introduction to EXPAH project, with its aims and objectives, is given. During the first year of lifetime, the EXPAH project has concentrated its efforts on implementing a few project actions functional to its progress. Monitoring of Polycyclic Aromatic Hydrocarbon (PAH) compounds in different living environments, upper air and surface meteorological monitoring and estimation of PAHs emissions in the studied area, are just examples of the ongoing activities. In this Newsletter descriptions and progress in these fields are briefly presented.

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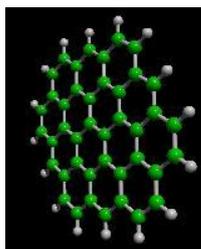
## 2 The Polycyclic Aromatic Hydrocarbon (PAH)

**What they are:** The Polycyclic Aromatic Hydrocarbons (PAHs) are chemical compounds contained in atmospheric fine particulate matter (PM<sub>2.5</sub>) and in gaseous fraction.

**Where do they come from:** They are produced by the incomplete combustion of organic matter. The main sources of emission are the road traffic, boilers of domestic heating and industries.

**What consequences:** The fine particulate matter which contains these compounds may have harmful effects on health of exposed people, with particular consequences on respiratory and cardiovascular apparatus. School children and elderly people are risk population.

**Legislation:** The Directive 2004/107/EC requires each member state to monitor the PAHs relevant for human health. Italy has placed PAHs on the 2009 national annual priority list, with the aim of developing a database able to support policy actions.



## 3. The LIFE+ EXPAH Project

The European Community funded a project (EXPAH) by means of LIFE financial instrument, with the aim to identify and to quantify population exposure among children and elderly people to Polycyclic Aromatic Hydrocarbons (PAHs) content in particulate matter in highly urbanized areas and to assess the impact on human health, in order to support environmental policy and regulation in this field. The city of Rome has been chosen as study area.

**An integrated project:** The project is based on an integrated approach where measurements, modeling techniques and epidemiologic investigations will be used to obtain estimation maps of population exposure to PAHs, to identify key determinants of high exposures including time-activity and locations in relation to the sources and to estimate potential health effects on the target population.

**“What if”:** Analysis will be conducted to evaluate the effectiveness of possible reduction measures of exposure.

### Expected results:

- A full emission inventory for air pollutants with PAHs for Rome;
- A dataset of indoor-outdoor PM<sub>2.5</sub> and speciated PAHs with personal exposure;
- Exposure maps of PM<sub>2.5</sub> and PAHs for Rome;
- A database for health assessment of PM<sub>2.5</sub> and PAHs.

#### 4. EXPAH Progress Status

The LIFE+ EXPAH project has reached the first 15 months of lifetime. Last June 2011 it finalized the Inception Report which presents intermediate results and evaluates the project progress against the objectives and workplan.

The first 15 months of activities have been focused on the following:

- Seasonal survey of time-activities of children and elderly people living in the city of Rome;
- Measurements of personal exposure to PAHs in the Metro of Rome
- Set-up of an analytical method to determine PAHs compounds in PM<sub>2.5</sub> and evaluation of uncertainties using standard certified powders.
- Determination of PAHs size-fraction distribution in PM in indoor and outdoor environments.
- Preliminary field campaign in two schools and one office to assess PAHs, EC/OC, metals and VOCs concentrations in indoor and outdoor environments as well as to compare the intra/inter-laboratory measurements end performances of different PM samplers.
- Meteorological field campaign in 4 stations to collect upper air and surface meteorological data with turbulence.
- Development of a PAH emission inventory for the studied area and comparison with other inventories available.
- Estimation of PAHs emissions from traffic data in the city of Rome.
- Definition of modeling domains and collection of cartographic, territorial and land-use data.
- Web site developing and updating, technical reporting and other dissemination activities.

#### 5. Estimation of population time-activities

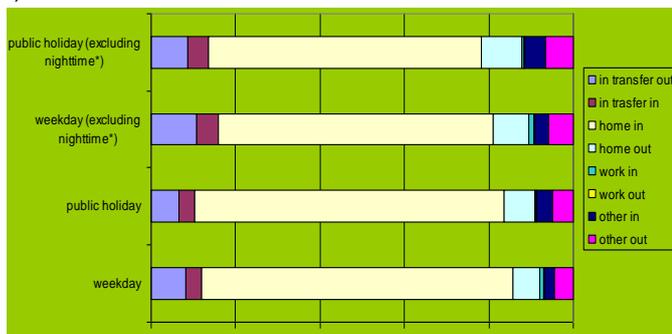
Under the EXPAH project an innovative evaluation of population exposure will be conducted. It will consider the actual concentration experienced in the environments visited during a day. As most of the time is spent by population in indoor environments, the analysis of population exposure to ambient particles and their PAHs content, must take into account different key aspects such as: indoor locations where people spend most time, their lifestyle, in particular the time they spend in different locations (home, office, school, parks and transport).

The project action 3.1 is carrying out a survey to collect data about the microenvironments visited during each hours of the day in the city of Rome. A form has been delivered to the target population (children and elderly) on a seasonal base for week-end and working days. Up to now more than 500 question forms have been collected in two field campaigns (april-june and july-november 2011). More data are expected for the next months. Some results are shown below.

a)



b)



Relative contribution of micro-environment to exposure. Children (a), Elderly (b).

#### 6. The PAH monitoring activities

PAH measurements field campaigns will be carried out in addition to the ongoing local air quality monitoring. Indoor-outdoor measurements will be carried out at different living places (e.g. home, office, school, car) to evaluate the ability of ambient PAHs to penetrate and pertain to these microenvironments. These results will be then used to develop an infiltration model. Personal exposure monitoring will be carried out in selected environments to evaluate model results and to quantify actual PAHs exposure.

In order to evaluate the inter/intra laboratory variations on PAHs sampling and analysis, the project action 3.2 carried out a preliminary field campaign in two schools and one office to collect indoor/outdoor PAHs, and VOCs data. A technical report about these activities will be soon available at the web.

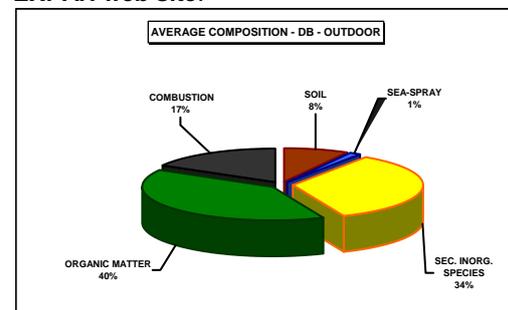


Outdoor PAH sampling



Indoor PAH sampling

In addition, a study on the chemical composition of PM<sub>2.5</sub> samples collected in indoor and outdoor environments by using different sampling devices was conducted to provide preliminary information about the indoor-outdoor differences of the daily concentration of PM mass, water-soluble inorganic compounds, elements, organic carbon (OC) and elemental carbon (EC). A **technical report** is available at the **EXPAH web site**.



Average composition of outdoor PM<sub>2.5</sub> at the DB site.



Preliminary measurements of PAH personal exposure were carried out in the Metro of Rome. A picture of this activity is shown beside. A **technical report** is available at the **EXPAH web site**.

### 7. The meteorological monitoring activities

The collection of meteorological data is required to feed the meteorological model. As the model should cover a large part of the studied territory, a set of monitoring stations, able to detect all atmospheric circulation aspects of area under study, are used.

The project action 3.4 is collecting since December 2010 high quality upper air and surface meteorological data. In addition to the existing monitoring network, four stations have been located in the city of Rome and its surroundings.



Pamphili urban park



Tor Vergata science park



Monteporzio Catone

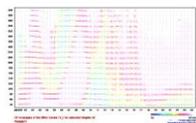


Montelibretti - CNR science park

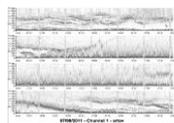
The following measurements are carried out:

- Wind vertical profile by SODAR
- Temperature vertical profile by RASS and Microwave radiometer
- Aerosol vertical profile by Ceilometer
- Surface turbulence by Triaxial sonic anemometers
- Heat fluxes
- Conventional meteorological parameters.

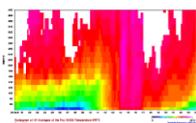
Below some examples of results are presented.



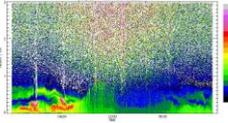
SODAR wind profile



SODAR ECHO-FACSIMILE



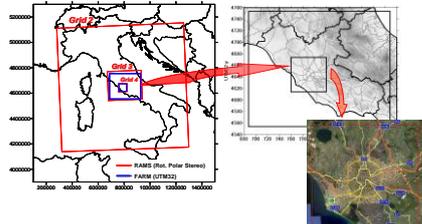
RASS temperature profile



Aerosol back-scattering prof.

### 9. The PAH modeling activities

The project actions 4.2 and 4.5 will use a state-of-art air pollution modelling system to estimate the ambient particles concentration and their PAHs content. Recent studies have found that the long range transport of PAHs contributes to less than 10% of concentrations over Rome urban area and up to more than 30% on the Apennine region and in Rieti Province. Based on these results EXPAH will model PAHs dispersion and transformation by means of three nested domains shown in the figures below. **More details** can be found in a presentation available **at the EXPAH web site**.



### 8. Estimation of PAH emissions

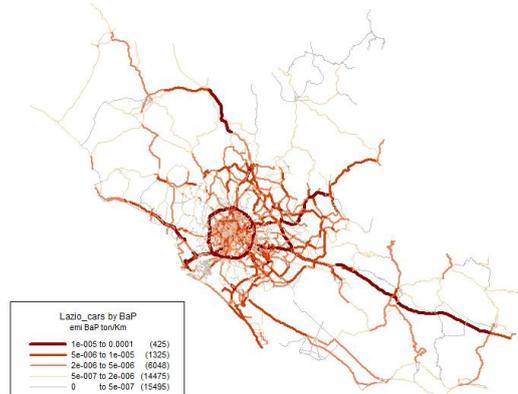
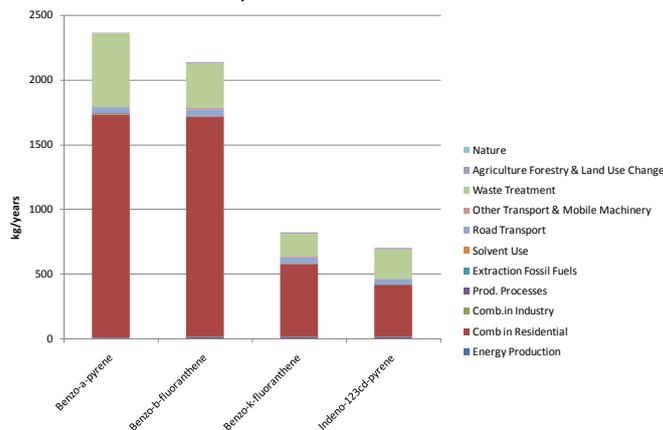
To simulate the dispersion and transformation of PAH, an estimation of their emissions is needed. This process requires developing of an emission inventory for the studied area. To be used in a model it must be spatially, temporally and chemically disaggregated. The above tasks are conducted in actions 4.1, 4.3 and 4.4 of the EXPAH project.

In order to develop a complete emission inventory for the city of Rome and its surrounding area, it has been necessary to integrate different sources of information characterized by diverse scales and space resolution, identify inconsistencies and integrate them to cover the space areas that will be covered by air quality model simulations. The Italian national Emission inventory (ISPRA2005), and other inventories available at European level (i.e. EMEP, TNO) have been used in the integration process. The national inventory is based on a top-down methodology and it has been disaggregated at province level. European inventories are distributed as gridded pollutants emission values that are therefore not directly connected with administrative units.

The analysis of emissions over Lazio Region and Rome metropolitan area confirmed that the main sources of PAH are, in order of relevance:

- Combustion in residential heating,
- Waste treatment,
- Road transport;

The figure below shows the speciated PAH emissions in Lazio Region. An intercomparison of different datasets emission puts in evidence the large degree of uncertainty that affects PAH emissions. **Details** on the emission inventory are shown in a technical report available **at the EXPAH web site**



**Detailed traffic emissions:** PAH emissions have been calculated for each road by means of a model based upon the COPERT IV methodology starting from vehicles flow in the Rome road network estimated by the Rome city authority by means of a traffic assignment model representing the traffic flows on the road network, on the basis of origin-destination matrices and traffic data. The picture above shows the BaP yearly emissions for cars.

**EXPAH Project Office****Web site**<http://www.ispesl.it/expah>**Project office**AZIENDA SANITARIA LOCALE  
ROMA EDepartment of Epidemiology  
Via di Santa Costanza, 53  
00198 Rome, Italy**Project Manager**

Dr. Francesco Forastiere

E-mail: [forastiere@asplazio.it](mailto:forastiere@asplazio.it)

Phone: +39 06 83060484

FAX: +39 06 83060374

**Project Coordinator**

Dr. Claudio Gariazzo

INAIL – Research center

E-mail: [c.gariazzo@inail.it](mailto:c.gariazzo@inail.it)

Phone: +39 06 97896228

FAX: +39 06 94181527

**Project Secretariat**

Patrizia Compagnucci

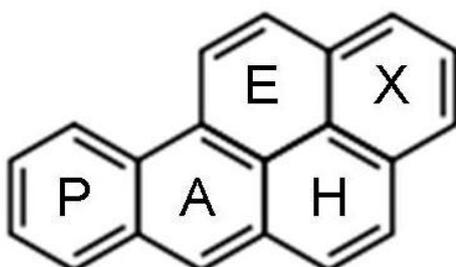
E-mail: [compagnucci@asplazio.it](mailto:compagnucci@asplazio.it)

Phone: +39 06 83060404

FAX: +39 06 83060374

**IMPORTANT NOTICE**

The EXPAH newsletters can be ordered by sending an e-mail to the following address: [expah@asplazio.it](mailto:expah@asplazio.it). If you do not wish to receive this newsletter, send an e-mail to the same address and you will be removed from the mailing list.

**EXPAH Factsheet**

|                           |  |
|---------------------------|--|
| Project title             | Population exposure to PAH                     |
| Project acronym           | EXPAH  |
| Duration of the project   | 1/10/2010 – 31/12/2013                         |
| Total project budget      | 2,037,749 €                                    |
| EC financial contribution | 978,202 € (= 49.98 % of total eligible budget) |

**EXPAH Partners**Department of Epidemiology  
Lazio Regional Health ServiceRicerca  
tecnico-scientifica

ARPALAZIO

NATIONAL INSTITUTE  
FOR HEALTH AND WELFARE**Recent Reports and Presentations**

- 8th International Conference Air Quality - Science and Application, Athens 2012. The LIFE+ Population Exposure to PAH (EXPAH) Project: indoor/outdoor monitoring and emissions estimation in Rome.
- Eurotox Conference - 47th Congress of the European Societies of Toxicology, (Porte Maillot, Paris, France).  
[http://www.ispesl.it/expah/documenti/Poster\\_Expah%20Eurotox.pdf](http://www.ispesl.it/expah/documenti/Poster_Expah%20Eurotox.pdf)
- Comparison study of PM<sub>2,5</sub> chemical composition by using MV and LV samplers. Technical Report - action 3.2.2.  
<http://www.ispesl.it/expah/documenti/TechnicalReport-ComparisonstudyofPM2,5chemicalcomposition>
- Long range transport of PAHs and definition of computational domains for Rome city simulations. Action 4.2.  
[http://www.ispesl.it/expah/documenti/Expah\\_4.2\\_computational\\_domain\\_&\\_minni2005.pdf](http://www.ispesl.it/expah/documenti/Expah_4.2_computational_domain_&_minni2005.pdf)
- Ancillary Measurements and the Intercomparison Study – Action 3.2.3 Inter-comparison.  
[http://www.ispesl.it/expah/documenti/TechnicalReport\\_CNR\\_01%20action%203.2.3.pdf](http://www.ispesl.it/expah/documenti/TechnicalReport_CNR_01%20action%203.2.3.pdf)
- Collection of raw emission inventories and their upgrading. ACTION 4.1. [http://www.ispesl.it/expah/documenti/R2011-13\\_ARIANET\\_EXP AH\\_A4.1.pdf](http://www.ispesl.it/expah/documenti/R2011-13_ARIANET_EXP AH_A4.1.pdf)