Population Exposure to PAH EXPAH

EXPAH ENV/IT/000082 April 2013, Issue 3

Welcome to 3rd issue of the Newsletter

Editorial

The EXPAH partners are pleased to present the third 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 as well as comments are always welcome (send to **expah@deplazio.it**).

In this number a brief introduction to the latest results delivered by the EXPAH project is given. The final indoor/outdoor monitoring results of Polycyclic Aromatic Hydrocarbon (PAH) compounds in schools, homes, offices, cars and buses are presented. The survey on time activities of children and elderly people living in the city of Rome provided its final results and are here presented. The PAHs and PM2.5 modeling activities in the urban area of Rome has also came to conclusion and the main results are briefly presented. Finally the GIS system developed for the EXPAH project is presented.

The LIFE+ EXPAH Project

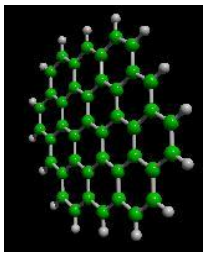
The European Community funded a project (EXPAH) by means of LIFE financial instrument, with the aim to identify and to quantify population exposure among children and elderly people to Polycyclic Aromatic Hydrocarbons (PAHs) content in particulate matter in highly urbanized areas and to assess the impact 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 $PM_{2.5}$ and speciated PAHs with personal exposure;
- Exposure maps of $PM_{2.5}$ and PAHs for Rome;
- A database for health assessment of $PM_{2.5}$ and PAHs.



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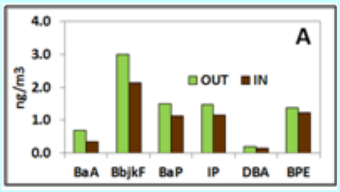
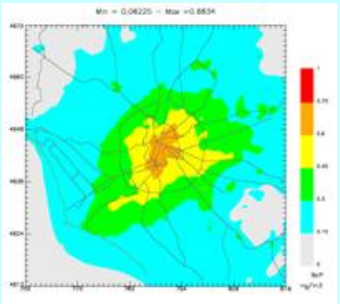
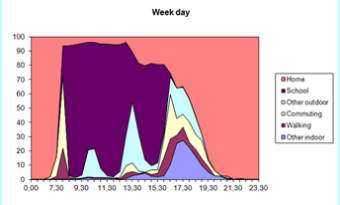
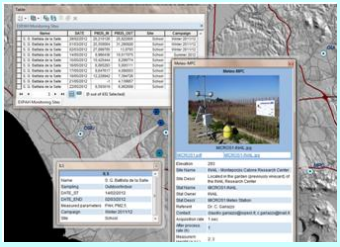








EXPAH Progress Status

The LIFE+ EXPAH project has reached the 31 months of lifetime.

During the latest period the activities have been focused on the following:

- Finalization of the seasonal survey of time-activities of children and elderly people living in the city of Rome;
- Finalization of the indoor/outdoor PAHs and PM2.5 chemical analysis of filters sampled in 20 living places among schools, homes, offices, cars and buses.
- Finalization of PAHs personal exposure measurements of children and elderly people living in the city of Rome.
- Finalization of the meteorological simulations for the reference year (summer 2011-summer 2012).
- Finalization of model simulations of PAHs, PM2.5 and gaseous pollutants in the in the target domain of the urban area of Rome.
- Mid-term EXPAH conference on progress status of the project and its latest results.
- Start of the statistical analysis of indoor/outdoor PAHs and PM2.5 and corresponding I/O ratios
- Start of the developing of the exposure model
- Start of the study on possible emission scenarios on planned or future local, National and EU policies for PAHs
- Start of the study on short-term and long-term health impacts of PAHs exposure.

Recent Reports

- Comparison study of PM2,5 chemical composition by using MV and LV samplers. Techical Report - action 3.2.2. http://www.ispesl.it/expah/documenti/TechicalReport-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
- 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
- Collection of raw emission inventories and their upgrading. ACTION 4.1. http://www.ispesl.it/expah/documenti/R2011-13_ARIANET_EXPAH_A4.1.pdf
- Technical Report on activities carried out by CNR-IIA and INAIL - ex ISPESL in the frame of the EXPAH Project (Actions 3.2). http://www.ispesl.it/expah/documenti/TR_2011_CNR-INAIL.pdf
- Instructions, information and remarks for the regular in-field campaigns of the EXPAH Project (Laboratory and in-field activities), Action 3.2. http://www.ispesl.it/expah/documenti/TR_2011_CNR-INAIL-recommandations%20action%203.2.pdf
- Integration of PAHs atmospheric processes within FARM model. http://www.ispesl.it/expah/documenti/R2012-01_ARIANET_EXPAH_A4.5.pdf
- Calculation and integration of traffic emissions with the updated Lazio Region inventory. http://www.ispesl.it/expah/documenti/R2012-05_ARIANET_EXPAH_A4.3-4_final.pdf
- Preliminary report on time-activity data of population groups of Rome. http://www.ispesl.it/expah/documenti/Survey%20on%20children%20and%20elderly%20people%20time%20activity%20in%20Rome-action%203.1.%20final%20report.pdf
- Technical report on meteorological measurements (action 3.4). http://www.ispesl.it/expah/documenti/Technical%20report%20on%20meteorological%20measurementsrev1.pdf

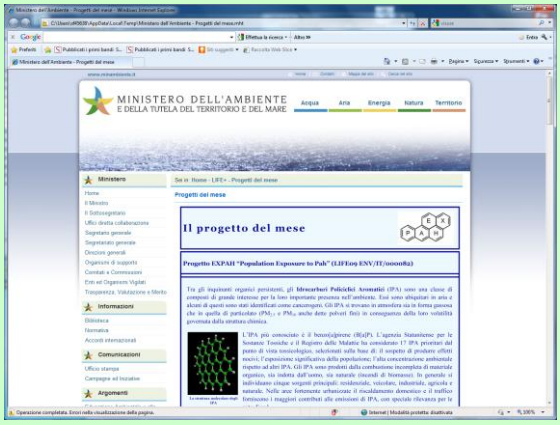
Recent presentations and publications

- 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. http://www.ispesl.it/expah/documenti/AQC2012-garic00536.pdf
  PAH distribution in the size-segregated aerosols of a work office. http://www.ispesl.it/expah/documenti/UAQ2012_EXPAH-Cecinato.pdf
- Eurotox Conference - 47th Congress of the European Societies of Toxicology, (Porte Maillot, Paris, France). http://www.ispesl.it/expah/documenti/Poster_Expah%20Eurotox.pdf
- V convegno nazionale Il Controllo degli Agenti Fisici: Ambiente, Salute e Qualità della Vita. Novara giugno 2012. Il Progetto LIFE+ Population Exposure to PAH (EXPAH): esposizione Indoor/outdoor in ambienti di vita e stima delle emissioni nella città di Roma. http://www.ispesl.it/expah/documenti/A12%20-%20GARIAZZO_ET%20_ALL.pdf
- Convegno Nazionale AMBIENTE, ENERGIA, SOSTENIBILITA' NEI PROGETTI LIFE ITALIANI. Brescia – Italy May 2012. Progetto EXPAH (population EXposure to PAH): risultati del monitoraggio indoor/outdoor e stima delle emissioni di IPA a Roma. http://www.ispesl.it/expah/documenti/expah_brescia_8min.pdf
- 16th International Symposium for the Advancement of Boundary-Layer Remote Sensing. Boulder – Colorado USA June 2012. http://www.ispesl.it/expah/documenti/ISARS%202012%20Extended%20Abstract%20gariazzo%20et%20al_rel3.pdf
- 5th National Symposium on Atmospheric Particulate (PM2012). Perugia -Italy June 16th-18th, 2012. Progetto EXPAH: IPA cancerogeni in ambienti indoor (scuole, case, uffici, veicoli). http://www.ispesl.it/expah/documenti/Poster-Perugia_EXPAH.pdf
- Seminar at CNR-ISAC National Research Institute. http://www.isac.cnr.it/documenti/seminari/Gariazzo_Claudio_pre_20120502.pdf
- 12th Sigma Aldrich Young Chemists Symposium S.A.Y.C.S., Riccione, October 1-3, 2012. "Idrocarburi aromatici volatili in ambienti indoor e outdoor a Roma". http://www.ispesl.it/expah/documenti/Poster-SAYCS_expah.pdf
- ECOMONDO, Rimini, November 8, 2012. "Idrocarburi policiclici aromatici nell'aria delle scuole e nelle case di Roma: similitudini e peculiarità". http://www.ispesl.it/expah/documenti/Presentazione-Ecomondo_EXPAH.pdf
- Convegno La qualità dell'aria a Roma: le evidenze disponibili, gli effetti sulla salute e il progetto Expah. Rome December 2012. http://www.ispesl.it/scripts/sel_appd.asp?area=3&lang=it&id=992&mod=1&history=yes

Achieved milestones and deliverables

- Kick-off EXPAH meeting
- Website finalisation
- Mid-Term EXPAH conference
- Simulation of PAHs emission, dispersion, transformation in the base case scenario
- Finalisation of a model ready PAHs emission inventory
- End of collection and analysis of meteorological data, indoor/outdoor PAH, PM components and personal exposure data with data sets

Dissemination activities



Contribution to web pages

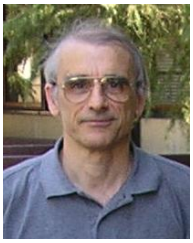
Mid-Term EXPAH conference

As for the dissemination to the public a presentation of the EXPAH project has been published in the Environment Ministry web site.

The EXPAH Mid-Term conference hosted both public and local authorities. Available results were presented.

The INAIL web site hosted a press release about the INAIL contribution to the European Air Quality year. A specific section devoted to the EXPAH project was included.

Indoor/outdoor PAHs in schools, home and offices of Rome



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The core of Life+ EXPAH project, namely PAH evaluation in indoor and outdoor micro-environments, was carried out by sampling $PM_{2.5}$ from Nov. 2011 to Jul. 2012. Six schools, nine homes and two offices were the target sites. Protocol campaigns were performed in winter and spring/summer. Other measurements were made at ARPA Lazio stations and extra-sites. PAHs were analyzed according to a procedure optimized at CNR-IIA and based on low-volume collection of PM, solvent extraction, column chromatography clean-up and CGC-MSD analysis. ARPA stations collected PM2.5 at medium-volume conditions (EN 12341 method). The following PAHs compound were identified and measured:

PAH compound	*Symbol*
benz[a]anthracene	BaA
benzo[bjk]fluoranthene	BbjkF
benzo[a]pyrene	BaP
indeno[1,2,3-cd]pyrene	IP
dibenz[a,h]anthracene	DBA
benzo[g,h,i]perylene	BPE

***Table 1**: PAH's congeners measured.*

Results

Fig. 1 shows the mean PAHs recorded at the schools.

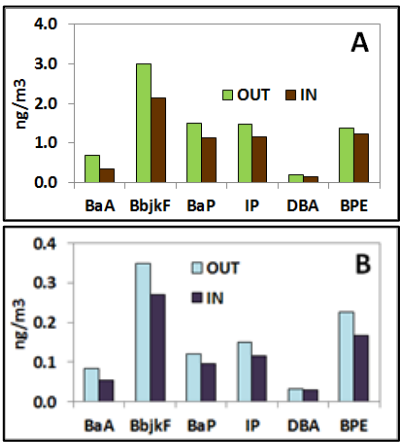

***Fig. 1 –** Average PAHs recorded at schools in winter (A) and spring (B)*

Figure 2 provides the PAH burdens in the home soot, while figure 3 shows the average PAHs at offices. In general, indoor PAHs were lower than the respective outdoors.

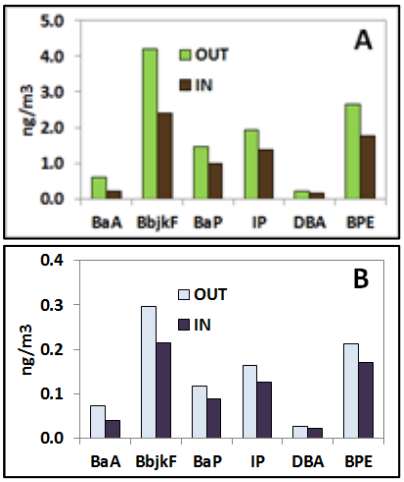

***Fig. 2 –** Average PAHs recorded at homes in winter (A) and spring (B)*

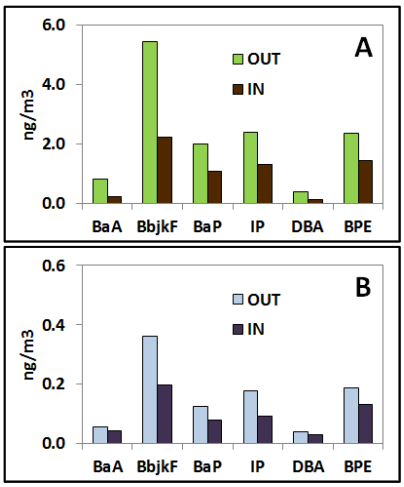

***Fig.3 –** Average PAHs recorded at offices in winter (A) and spring (B)*

As for ARPA Lazio stations, the mean concentrations of PAH congeners are shown in Fig. 4.

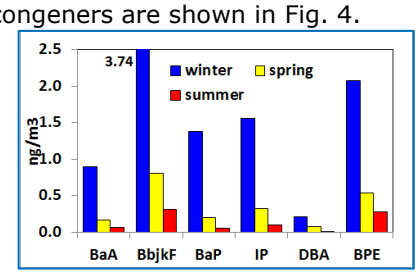

***Fig. 4 –** PAHs at ARPA Lazio stations in winter, spring and summer.*

PAH values at ARPA stations were a bit higher than outdoors at schools, but not at homes and offices. As for homes, passive tobacco smoking is suspected to contribute to PAH occurrence. It is worth noting that during the first winter campaign PAHs were, on the average, more abundant in weekdays than in weekends (Fig. 5). For more information see the technical report available at EXPAH web site.

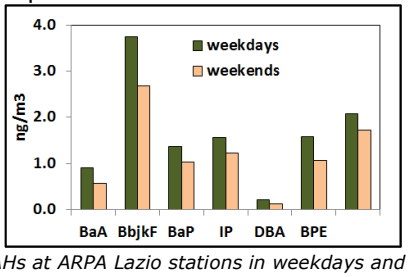

***Fig. 5 –** PAHs at ARPA Lazio stations in weekdays and weekends of winter (Nov.÷Dec. 2011).*

Indoor/outdoor PAHs in cars and buses of Rome

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Although outdoor air pollution contributes to adverse health effects, high levels of air contaminants may occur in some microenvironments like vehicles. This has important implications for exposure assessment because people spend a significant part of time in commuting and a large amount of exposure is expected to come from the in-vehicle ventilation system.
In the frame of the LIFE+ EXPAH Project, we carried out measurements of PM 2,5-bound PAHs in one bus and two cars in Rome. Samplings were performed in real driving conditions, during two "fifteen days" seasonal campaigns (winter and summer), by simultaneously monitoring indoor and outdoor environments (Fig. 1). PM 2,5 was collected on PTFE filter and high-molecular-weight PAHs were determined by GC-MS: carcinogenic benz[a]anthracene (BaA), benzo[bjk]fluoranthene (BbjkF), benzo[a]pyrene (BaP), indeno[1,2,3-cd]pyrene (IP), dibenz[a,h]anthracene (DBahA) and mutagenic benzo(g,h,i)perylene (BPE).

Figure 1: *Sampling performances in bus and cars*

The 90 express Bus is electrically powered for most of its route: it was approximately 10 km long with 20 bus stops (Fig. 2). Most of the time the bus travelled on one of the most heavily congested streets in Rome, and for the rest of the time across some single-lane residential and heavily congested historic centre streets with medium traffic densities. One way run route took approximately 45 minutes to be completed.

Figure 2: *Bus 90 express and its urban route*

Regarding cars sampling, it was carried out in two private vehicles (a petrol/liquefied gas petroleum car – CAR1 – and a diesel car – CAR 2 –) along urban routes (with a moderate/high traffic congestion) typically during the time to get to work, in the morning from 7 to 9 and in the afternoon. Each monitoring activity was performed by sampling 2h/day for a week, by replacing the Teflon filter every about 10 hours. So far, PAH's concentration results integrated over a period of about a week. The "bus" campaigns were performed in March and June2012. The sampling periods, lasting for 10 weekdays, consisted of a daily monitoring (8h/day) from 9:00 to 17:00. Samples were analyzed for PAH on a daily basis. The "cars" winter campaign lasted from November 2011 to January 2012 and from June to August 2012. Five monitoring intervals (weeks) were recorded for the CAR 1, and eight for CAR 2; in total six winter weeks and seven summer weeks.

Indoor/Outdoor PAHs

Table 1 summarizes the results for the bus: for each congener the mean value, minimum, maximum and relative standard deviation is reported, for both the indoor and the outdoor values, in winter and summer (N=10); the ratio BaP/ΣPAHs is also reported: it indicates the relative proportion of BaP among the PAHs investigated. The final column reports the indoor to outdoor ratio (I/O), and its average value.

	WINTER - BUS								
	INDOOR				OUTDOOR				I/O
	Avg	Min	Max	SD %	Avg	Min	Max	SD %	Av.=1.0
BaA	0.61	0.38	1.10	35	0.70	0.53	0.98	22	0.9
BbjkF	1.19	0.69	1.84	30	1.20	0.76	1.57	21	1.0
BaP	0.76	0.46	1.39	38	0.65	0.40	0.83	23	1.2
IP	0.78	0.47	1.41	34	0.69	0.43	0.91	24	1.1
DBahA	0.11	0.07	0.23	43	0.10	0.08	0.14	24	1.0
BPE	0.66	0.48	1.02	25	0.62	0.41	0.85	20	1.1
ΣPAHs	4.11	2.73	6.55	29	3.97	2.77	5.23	20	1.0
BaP/PAHs	0.18	0.16	0.21	8	0.16	0.14	0.19	-	-
	SUMMER - BUS								
	INDOOR				OUTDOOR				I/O
	Avg	Min	Max	SD %	Avg	Min	Max	SD %	Av.=1.0
BaA	0.10	0.05	0.23	53	0.11	0.07	0.16	25	0.9
BbjkF	0.24	0.13	0.59	70	0.22	0.14	0.52	52	1.1
BaP	0.09	0.04	0.24	77	0.09	0.05	0.29	85	1.1
IP	0.12	0.05	0.23	55	0.11	0.06	0.28	53	1.0
DBahA	0.01	0.00	0.05	316	0.01	0.00	0.09	316	0.6
BPE	0.12	0.06	0.28	55	0.13	0.07	0.22	34	0.9
ΣPAHs	0.67	0.33	1.51	62	0.67	0.41	1.54	49	1.0
BaP/PAHs	0.13	0.11	0.18	17	0.12	0.10	0.19	-	-

Table 1*: Indoor and outdoor PAH's congeners concentration at Bus.*

	WINTER - CARS								
	INDOOR				*OUTDOOR*				*I/O*
	Avg	Min	Max	SD %	Avg	Min	Max	SD %	Av.=0.7
BaA	0,56	0,26	0,70	29	1,05	0,25	1,88	55	0,5
BbjkF	1,27	0,58	1,92	37	1,89	0,49	3,00	56	0,7
BaP	0,92	0,41	1,54	44	1,32	0,30	2,25	59	0,7
IP	0,71	0,38	1,13	40	0,92	0,22	1,40	55	0,8
DBahA	0,17	0,07	0,29	42	0,19	0,07	0,47	76	0,9
BPE	0,94	0,39	1,86	56	1,34	0,28	2,92	69	0,7
ΣPAHs	4,57	2,19	7,31	39	6,72	1,61	11,0	57	0,7
BaP/PAHs	0,20	0,18	0,22	-	0,19	0,18	0,22	-	-
	SUMMER - CARS								
	INDOOR				*OUTDOOR*				*I/O*
	Avg	Min	Max	SD %	Avg	Min	Max	SD %	Av.=0.9
BaA	0,07	0,03	0,11	42	0,11	0,03	0,17	50	0,7
BbjkF	0,22	0,14	0,30	24	0,24	0,16	0,30	21	0,9
BaP	0,12	0,10	0,14	15	0,13	0,09	0,19	26	0,9
IP	0,14	0,09	0,18	27	0,15	0,11	0,22	23	0,9
DBahA	0,01	0,00	0,04	171	0,01	0,00	0,06	265	1,3
BPE	0,08	0,05	0,12	30	0,13	0,07	0,22	26	0,7
ΣPAHs	0,64	0,46	0,82	20	0,67	0,41	1,54	20	0,8
BaP/PAHs	0,19	0,15	0,22	13	0,12	0,10	0,19	-	-

Table 2*: Indoor and Outdoor PAHs concentration at Cars.*

We can observe that during the winter BaP resulted sometimes (Bus indoor; cars indoor and outdoor) exceeding or being next to the guideline value of 1 ng/m^3, whereas the summer values were well below. Moreover, the I/O ratio ranging from 0.7 to 1.0 indicates the extent of the capacity of the outdoor concentration to penetrate indoor of vehicles, by also underlines a different behaviour for bus and cars. So far, it has been remarked that in assessing people exposure to air contaminants in urban area the contribution of in-vehicles cannot be neglected.

For more information see the technical report available at EXPAH web site.

Seasonal time activities of children and elderly people living in Rome

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The action 3.1 (**Estimation of time activity data and analysis**) of the EXPAH project aimed to collect and analyze time activity data of population groups to get information of which kind of environment (home, school, car bus, outdoor, etc) are attended during a weekday and a public holiday. Such data will be used to estimate the PAH exposure experienced by population during its typical day, evaluated as a weighted exposure of the different pollutants levels of the most visited micro-environments. The city of Rome was selected of this study and both children and elderly people were interviewed by questionnaire to collect time activity data on a seasonal basis and for two days of the week, Sunday (public holiday) and Wednesday (week-day).

We performed two kind of analysis of the data: a time slot analysis (by half-hour periods) and a daily analysis. For the time slot analysis we calculated the half an hour distribution of the time activities in percentage, stratifying by season (spring/summer and autumn/winter) and day of the week (public holiday and week-day), in the total population and in males and females, separately. For the daily analysis we calculated the daily distribution of the time activities in percentage, stratifying by season (spring/summer and autumn/winter), day of the week (public holiday and week-day) and gender (males and females).

In Figure 1 the results of daily analysis is reported.

Parents of 483 children aged 7/8 years were interviewed. The results show that home is the most frequent micro-environment (47-71% of time depending on season, type of day and gender) where children spend their time. School is the second most visited place with about 28% of time. Not negligible is the amount of time spent in different outdoor activities (6-24% depending on season and type of the day). Walking and commuting get respectively about 3 and 5% of time in a day, while other indoor activities, such as sport, are done during about 3-10 % of time. Figure 2 shows the hourly time-activity data of children during a typical autumn/winter week day.

A total of 707 elderly people aged 65-85 years were interviewed. The results (figure 3) indicate a high prevalence of the time spent at home (65-81% depending on season, type of day and gender). Other outdoor activities follow with about 3-14% depending season and type of the day. Commuting needs about 3-5% of time, while walking get an amount of time between 5 and 10%. Other indoor places, such as friend's houses, are visited for about 4-9% depending on season, gender and type of the day. Such data have been collected for the first time in the city of Rome.

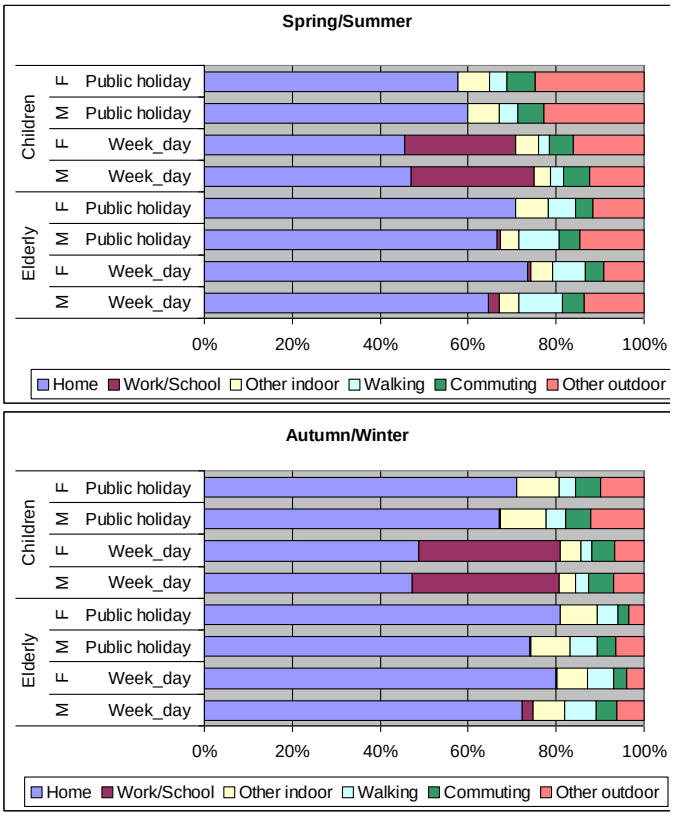

Figure 1 *Daily data for children (N=483) and elderly (N=707) by season, day of the week, gender and type of activity.*

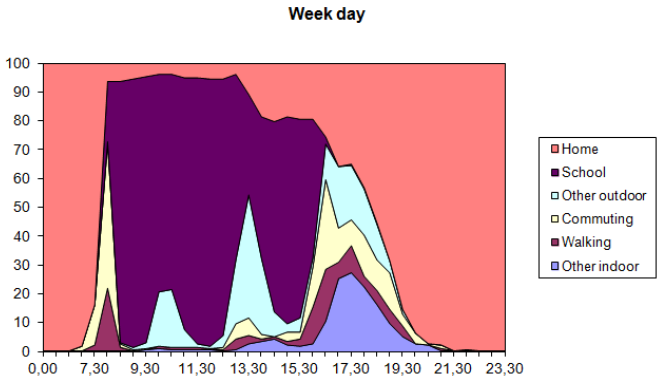

Figure 2 *Activity data by day of the week, time slot and type of activity. Children, Autumn/Winter*

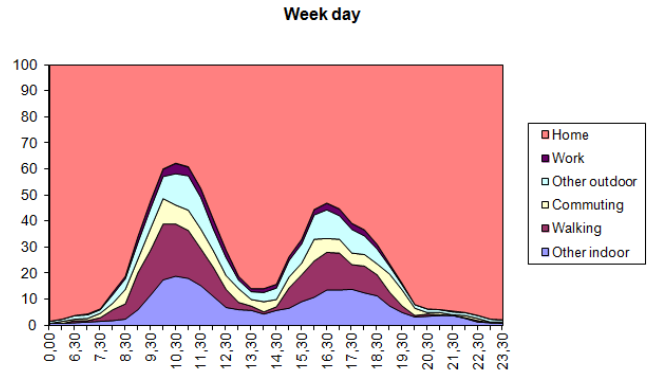

Figure 3 *Activity data by day of the week, time slot and type of activity. Elderly, Autumn/Winter*

Detailed results about this survey can be found in a technical report available at the EXPAH web site.

References

Technical report on survey of children and elderly people time activity in Rome-action 3.1.
http://www.ispesl.it/expah/documenti/Survey%20on%20children%20and%20elderly%20people%20time%20activity%20in%20Rome-action%203.1.%20final%20report.pdf

Modeling of PAHs and PM2.5 in the urban area of Rome

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The extended version of the chemical transport model (CTM) FARM (Flexible Air quality Regional Model), has been applied over Rome urban area to provide PAHs (i.e. B[a]P), B[b]F, B[k]F and indeno(1,2,3-cd)pyrene) concentration fields to infiltration and exposure models. The CTM worked on a target domain 60x60 km^2 wide, with a horizontal resolution of 1 km, 16 terrain-following vertical levels (irregularly spaced from the ground to 10000 m a.g.l.), from June, 1st 2011 to May, 31th 2012. The CTM was driven by: meteorological input fields produced by the prognostic, non-hydrostatic meteorological model RAMS; boundary conditions derived from national scale simulation at 12 km horizontal resolution; emissions prepared by merging Lazio Region and National (ISPRA 2005) inventories. To evaluate the performance of the CTM, simulated concentrations have been compared with observations collected by the monitoring network managed by ARPA Lazio. An example of such comparison is given in the following Figure 1 that evidences the capability of the adopted modelling system to reproduce observed $PM_{2.5}$, NO_2 and O_3 levels at the urban background site "Ada".

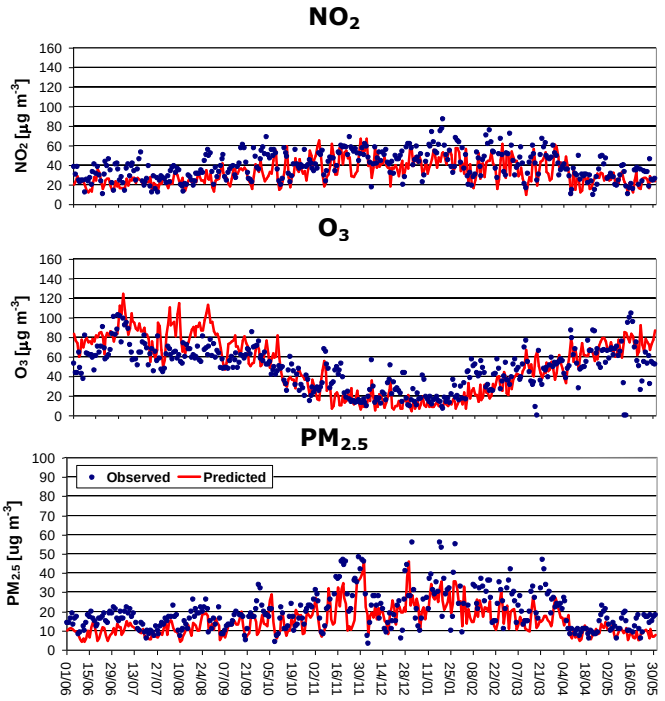

Figure 1. Comparison between observed and predicted $PM_{2.5}$, NO_2 and O_3 concentrations [µg m^{-3}] at the urban background site "Villa Ada".

During the investigated period, several field campaigns of particulate PAHs (indoor, outdoor and personal exposure) have been conducted in order to investigate the temporal and spatial distribution of these pollutants within Rome urban area. For each campaign, a comparison between observed and estimated PAH levels has been performed. An example of such comparison is presented in the following Figure 2 for summer, winter and spring periods.

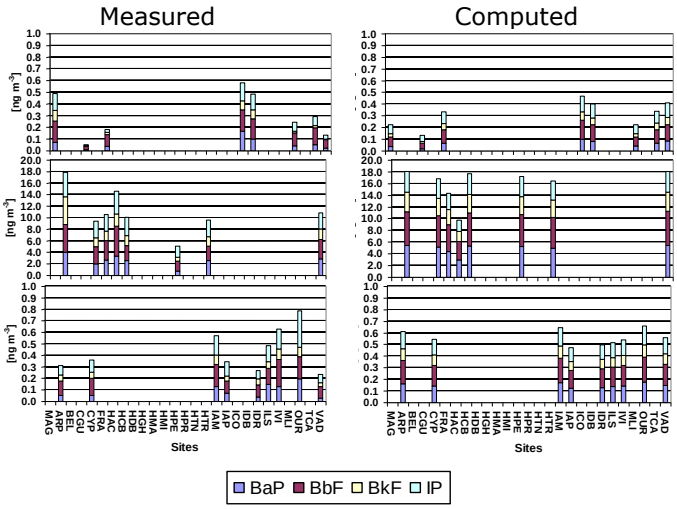

Figure 2. Observed and computed PAHs concentrations [ng m^{-3}]during summer (top: August, 2-7, 2011), winter (middle: January, 16-20 2012) and spring (bottom: May, 14-18 2012) periods at monitoring sites operating during EXPAH field campaigns.

The model was able to reconstruct PAHs concentration levels over Rome conurbation and to describe their seasonal variation. Nonetheless, an overestimation of observed concentrations is identified during cold periods when domestic heating is assumed to operate. This problem can be mainly attributed to the large uncertainty affecting PAHs emission estimate. To reduce overestimation and to provide more reliable data to exposure model, daily estimated PAHs values have been multiplied by a monthly factor f_m computed as the monthly average of the ratios between observed and predicted concentrations. Figure 3 shows the comparison of the "Index of Agreement (IOA)" indicator between the "reference run" (Base case) and the "corrected run" (f_m). It evidences the improvement on predicted B[a]P concentrations using this approach. Finally, in the following Figure 4, the yearly averaged B[a]P concentration field, obtained by using the before mentioned approach, is presented evidencing no exceedance of the limit value over the studied area.

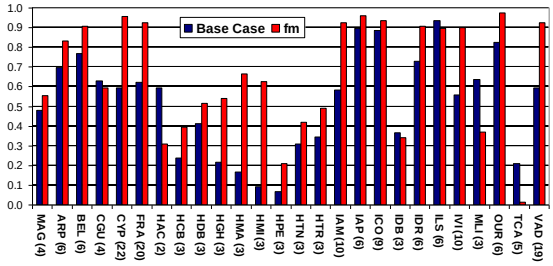

Figure 3. IOA computed for B[a]P at EXPAH monitoring sites (values between parenthesis indicate the number of data actually used).

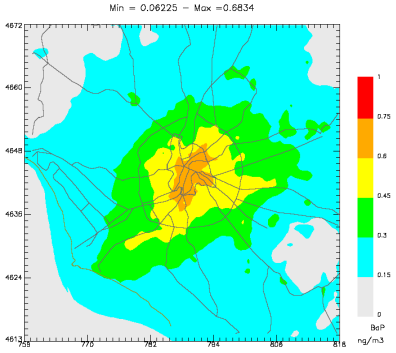

Figure 4. B[a]P yearly averaged concentrations over the target domain (limit value = 1 ng m^{-3}).

For more information see the technical report available at EXPAH web site.

The EXPAH Geographic Information System

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Action 8.1 is developing a Geographic Information System (GIS) that collects in an organized form the Project data and results having a geographic component. The goal is to highlight the geo-spatial relationships among the simulation results, on-site measurements and features of the geographic context that can support interpretation of the results. The GIS will also be used as a means to disseminate EXPAH Project results, via a WEB-GIS with a simple and intuitive interface.

The main challenge concerns finding the best way to include the time dimension in the GIS. Time is a variable in all the data produced by the Project, but just recently taken into account in Geographic Science. Contemporaneously showing spatial and temporal relationships among the data can efficiently summarize results of the Project and is the main research aspect of this Action.

Definition of the data model was the first step of the system under development. It includes the cartographic reference system for display and maps, the display scales, the geographic domain, the contents (information to be shown, thematic layers materializing that information, data sources) and the metadata. Contents have been logically organized to define a template of the database that now is being populated with data (Table 1). Data are formatted, summarized, geo-referenced and processed if needed. Core data are provided by the Action Teams responsible for their production. As for cartographic reference, open data have been used when possible, referring to the corresponding web services. Population density for different age ranges was calculated from 2001 Census data (last available data at census tracts detail) and interpolated onto the grid used in the air quality simulations.

Thematic group	Geographic Information Layers
Cartographic Reference	Road and rail network; CORINE Land Use 2006; Administrative limits; Simulation domains; Digital elevation models (20-60-90 m resolution); Remote sensing images; Topographic maps
Atmospheric Properties	Atmospheric measurement sites location and description (characteristics, data acquisition periods, measured parameters). Both Project sites and Government sites used in simulations have been included
Emissions	Point, linear and diffuse sources 2009; Gridded total yearly emissions 2009 for different pollutants used as input to simulations;
Pollution Data	Chemical measurements sites location, description and data. Both Project and Government sites have been included. Data include all measurements performed during the Project as a function of time.
Exposure and Health	Population density on census tracts (2001); Health districts limits; population density (total, <14y, >65y) gridded on the simulation grid

Table N. 1 *Conceptual outline of data included in the database up to now.*

The GIS is developed using ESRI-ARCGIS Software Package. The WEB Interface will be built using Open Source software and Libraries.

Data listed in Table 1 have been included in a database and used to generate rendering solutions that will be transferred to a WEB GIS (under construction).

The system created is time-aware. At present, multi-temporal information refers to pollutants concentration measured at Project and Government sites. These data can be queried and animated on a temporal basis, showing locations where measurements are available at a certain date with graphical symbols proportional to the value of the parameter measured (Figure 1).

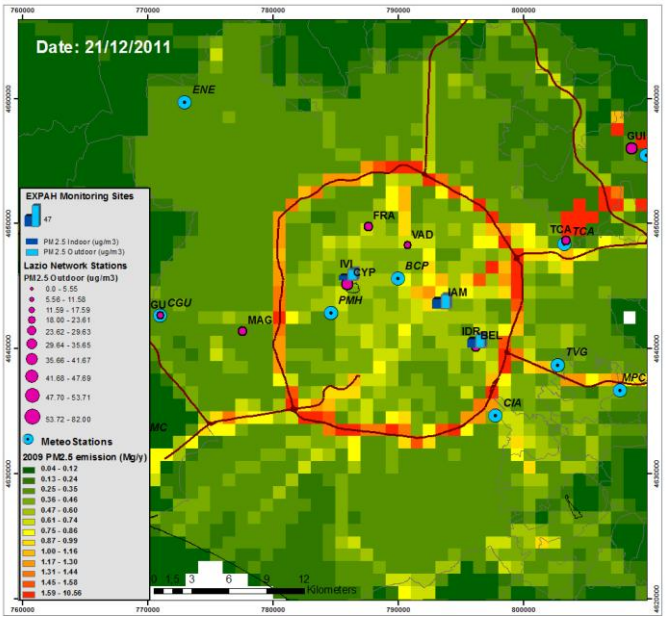

Figure N. 1 *Map of the PM2,5 measurements available on December 12, 2011 at both Project sites and Government monitoring stations. Point symbols are proportional to PM2,5 concentrations. Double bar symbols are used to report Indoor and Outdoor concentration. Yearly 2009 PM2,5 emission map is used as a basemap.*

Simply overlaying the population density map (not shown here) on pollution and emissions maps can give a first general idea on exposure.

Maps can be queried to obtain general and detailed information both on measurement sites. Absolute values of the parameters of interest can be shown both for point locations and for grid cells of the simulations models (Figure 2).

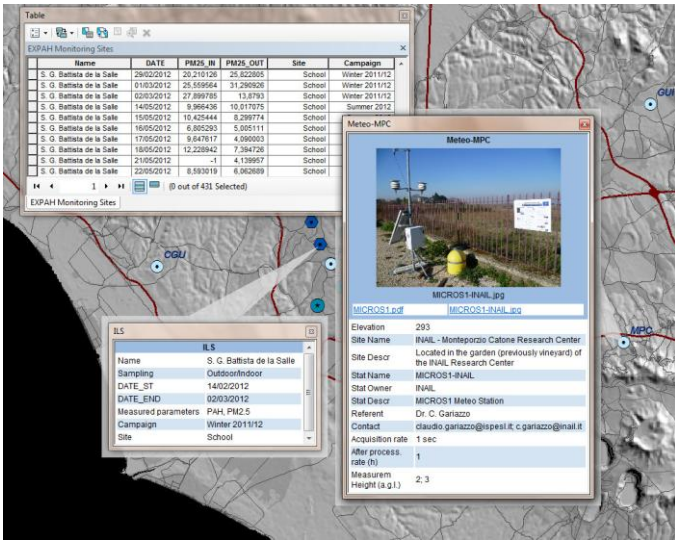

Figure N. 2 *Example of information directly retrievable from maps.*

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IMPORTANT NOTICE

The EXPAH newsletters can be ordered by sending an e-mail to the following address: expah@deplazio.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 – 30/06/2014
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 Service

INAIL Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro — Ricerca tecnico-scientifica

CNR-IIA

ARPALAZIO

ISAC

ARIANET

NATIONAL INSTITUTE FOR HEALTH AND WELFARE

Ongoing and Incoming activities

- Starting of statistical analysis of winter and summer indoor/outdoor PAHs and $PM_{2.5}$ data
- Developing of a microenvironment infiltration model
- Developing of an exposure model
- Evaluation of the short-term impact of PAHs and other pollutants on natural and cause specific mortality
- Evaluation of the short-term impact of PAHs and other pollutants on emergency hospital admissions
- Evaluation of the impact of long-term exposure in the occurance of lung cancer, coronary and cerebrovascular events
- Definition of possible emission scenarios from planned alternative future EU policies for PAHs and mitigation scenarios