EXPAH - Population Exposure to PAH.
LIFE09 ENV/IT/000082

Project description

Environmental issues

Beneficiaries

Administrative data

Read more

Contact details:

Project Manager: Francesco FORASTIERE
Tel: +39 06 99722180/181
Fax: +39 06 99722111
Email: f.forastiere@deplazio.it

Project description:

Background

Among persistent organic pollutants (POPs), polycyclic aromatic hydrocarbons (PAHs) are a class of complex organic chemicals of increasing concern. They are commonly found in ambient air and some have been identified as suspected carcinogens. PAHs and their derivatives are produced by the incomplete combustion of organic material. In highly urbanised areas domestic heating and motor vehicles are the largest contributors of PAHs. As a consequence, populations living in these areas are exposed to pollutants that potentially have negative impact on their health (e.g. lung, skin, and bladder cancer, DNA damage and increased risk of cardiopulmonary mortality). The EU Directive 2004/107/EC sets annual average target values for particulate matter. Furthermore, this directive requires each Member State to monitor several relevant PAHs. Italy has placed PAHs on the 2009 national annual priority list, with the aim of developing a database able to support related policy actions. In addition to traffic and domestic heating, Rome, one of the most urbanised cities in the Mediterranean area, suffers air pollution from two large airports, a large landfill for municipal solid waste, two waste incinerators and an oil refinery located within the city suburbs. Particulate matter (PM10) levels in the city are above the legal limit, and the 2010 air quality limit values were unlikely to be met. Health problems related to increased air pollution in the city looked set to continue.

Objectives
The EXPAH project aimed to address the environmental and health problems caused by the emission, dispersion and transformation of PAH compounds. Its overall goal was to identify and to quantify exposure among children and elderly people to PAH content in particulate matter in the city of Rome and to assess the impact on human health, in order to support environmental policy and regulation in this field. The project planned to adopt an integrated approach, based on measurements and modelling techniques. Its target was to build a prototype assessment method to provide basic knowledge on concentrations of PAHs in the city and their health impact. Analyses will be carried out to evaluate the effectiveness of possible reduction measures. The work would contribute to the development, assessment, monitoring and evaluation of environmental policies at local and national levels. The obtained results would also provide a valuable support to EU legislation on PAHs.

Results

The EXPAH project adopted an integrated approach, based on measurements and modelling techniques, to estimate the spatial distribution of the population’s exposure to PAHs and identify key determinants of high exposure levels – i.e. time, activity and location. The project also estimated the potential health effects on the target population. The modelling approach began with taking an emission inventory of the target area. The dispersion and transformation processes affecting these emissions were then simulated by a computer model to calculate the impact of PAHs on the air quality. PAHs exposure results were then used to assess the related health impacts. The potential effects on air quality of new EU and local policies were evaluated by modelling ‘what if’ scenarios. Based on the foreseen air quality impact, the corresponding effects on human health were then evaluated. This evaluation considered all involved processes, including indoor/outdoor infiltration factors, to estimate exposure in the visited living environments (taking into account the time spent in each of them).

The project targeted an important environmental problem, providing new data and tools to address it while taking into account existing EU policies. More specifically, it provided new evidence for the implementation of Directive 2004/107/EC which proposed a target value of 1 ng/m3 Benzo[a]pyrene (B[a]P) for the total content in the PM10 fraction averaged over a calendar year. This directive also suggests assessing the contribution of B[a]P in ambient air, and invites each Member State to monitor other relevant PAHs. However, PAHs are not continuously monitored as other regulated air pollutants, and therefore the time and spatial characteristics of the population exposure to PAHs are not well known. The project thus makes a significant contribution to EC legislation in this field, making suggestions for new mitigation actions.

Specific achievements included:

- State-of-the-art PAHs emission inventories for Rome – analysis showed that most emissions are linked to domestic heating and in particular to biomass combustion;
- The Chemical Transport Model FARM upgraded and improved to take PAHs emissions into account. It was integrated from the regional down to the local scale to determine the emissions, dispersion, atmospheric
transformation, and removal of transport-related pollutants with particular relevance to PAHs;

- Estimated concentration of particulate matter and PAHs in different areas of the city, using the existing monitoring network and field studies, in order to assess human exposure in different living places. (Seasonal PAHs concentration was monitored in 20 living environments (homes, schools, cars, buses and offices etc.) located around the city, as well as through the personal monitoring of PAHs exposure of nine individuals (children and elderly people). Results show a strong seasonality of exposure to PAHs which is higher during colder seasons. This occurrence is attributed to high emissions coming from domestic heating. Living environments do not seem to be protected by infiltration of outdoor pollutants.);

- An outdoor-indoor infiltration model able to estimate the amount of both particles and PAHs of ambient origin present in each predefined indoor micro-environment (the model showed that indoor PAHs concentrations are related to correspondent outdoor ones and that infiltration is estimated to be about 60-90%, depending on the PAHs compound and living environment);

- An exposure model based on micro-environments that was applied to provide seasonal and annual PAHs and PM2.5 exposure maps, with population exposure profiles, for both children and elderly people living in Rome. The analysis showed that the most important micro-environments were homes for the elderly and homes and schools for children. Seasonal exposure was confirmed although the legal annual limit of BaP is not exceeded. Due to the strong seasonality of PAHs exposure, legislation does not seem to represent a safe health protection limit. Indeed, a significant proportion of the population was found to be exposed to PM2.5 concentrations higher than the WHO guideline limit.

- An assessment of short- and long-term health effects of exposure to particles of different sizes and PAHs (mortality and morbidity). An increase in mortality for a variation in PAHs exposure within 2-5 days was found. In the longer term an increase in risk of mortality for non-accidental and cardiovascular causes was identified.

- Evaluation of the impact of existing, planned and alternative future EU policies and recommendations for mitigation strategies. The project discovered that without mitigation measures, the impact of PAHs is estimated to increase with consequent impacts on health. Conversely the transformation of biomass combustion in cleaner heating system seems to be effective in reducing environmental/health impact.

As a result of these activities, a series of detailed databases were set up and made available online in a GIS format:

- A full PAHs emission inventory for the Lazio Region and for the urban area of Rome;
- Datasets of indoor-outdoor PM2.5 and speciated PAHs as well as elemental and organic carbon particulate matter levels in dwellings during summer and winter;
- A dataset of personal exposure to PM2.5 and PAHs;
- Annual and seasonal exposure maps to PM2.5 and speciated PAHs for children and elderly people; and
- A database for health assessment with prototype software.
Further information on the project can be found in the project's layman report and After-LIFE Communication Plan (see "Read more" section).

Environmental issues addressed:

Themes

Air & Noise - Air quality monitoring
Risk management - Human health protection

Keywords

public health, environmental assessment, air pollution

Target EU Legislation

- Air
  - Directive 2008/50/EC - Ambient air quality and cleaner air for Europe (21.05.2008)

Natura 2000 sites

Not applicable

Beneficiaries:

Coordinator

Azienda Sanitaria Locale Roma E - Dipartimento di Epidemiologia

Type of organisation

Research institution

Description

The Department of Epidemiology in the ASL-RE (Rome E Local Health Authority) is a public health and research institution in charge of regional epidemiologic monitoring.
Partners
INAIL, Italy CNR-Istituto Inquinamento Atmosferico (Rome), Italy CNR-Istituto di Scienza dell’Atmosfera e del Clima (Rome), Italy THL–National Institute for Health and Welfare, Finland Arianet S.r.l (Milan), Italy Agenzia per la Protezione Ambientale Lazio (Rieti), Italy

Administrative data:
Project reference LIFE09 ENV/IT/000082
Duration 01-OCT-2010 to 30-JUN -2014
Total budget 2,037,749.00 €
EU contribution 978,202.00 €
Project location Lazio(Italia)

Read more:
Leaflet Title: "Integrare misure, modelli ed epidemiologia per la valutazione dell'impatto sulla salute degli idrocarburi polciclici aromatici" (15.5 MB) Author: Dott. Claudio Gariazzo Editor: INAIL No of pages: 1
Leaflet Title: "Integrating measurements, modeling and epidemiology to assess health impact of Polycyclic Aromatic Hydrocarbons" (15.5 MB) Author: Dott. Claudio Gariazzo Editor: INAIL No of pages: 1
Newsletter Title: "Newsletters of the EXPAH LIFE+ project n°2 : Population Exposure to PAH EXPAH" (1.50 MB) Year: 2012 Editor: INAIL No of pages: 11
Newsletter Title: "Newsletters of the EXPAH LIFE+ project n°1 : Population Exposure to PAH EXPAH" (782 KB) Year: 2012 Editor: INAIL No of pages: 4
Newsletter Title: "Newsletters of the EXPAH LIFE+ project n°4 : Population Exposure to PAH EXPAH" (1.2 MB) Year: 2013 Editor: INAIL No of pages: 10
Newsletter Title: "Newsletters of the EXPAH LIFE+ project n°3 : Population Exposure to PAH EXPAH" (1.36 MB) Year: 2013 Editor: INAIL No of pages: 9
Poster Title: "Esposizione della popolazione a IPA" (1.31 MB) Editor: INAIL No of pages: 1
**Poster**

Title: "Esposizione della popolazione a IPA n°2" (1.76 MB) Editor: INAIL No of pages: 1

**Project web site**

Project's website

**Publication: After-LIFE Communication Plan**

Title: After-LIFE Communication Plan No of pages: 9

**Publication: Layman report**

Title: Layman report No of pages: 20

**Publication: Technical report**

Title: "Esposizione della popolazione a IPA : Population Exposure to PAH EXPAH : Rapporto di sintesi" (1.81 MB) Author: Gariazzo Claudio Year: 2014 No of pages: 24

**Publication: Technical report**

Title: "EXPAH - ACTION 7.1 : Report on evaluation of policy and mitigation scenarios (revision)" (444 KB) Author: P.Radice, S.Finardi Year: 2014 Editor: ARIANET No of pages: 15

**Publication: Technical report**

Title: Project's Final technical report Year: 2014 Editor: Azienda Sanitaria Locale ROMA E No of pages: 82

---

**Project description**  Environmental issues  Beneficiaries  Administrative data

Read more