

LIFEINDEXAIR

NEWSLETTER 05

THE AIR BELONGS TO EVERYONE



THIS PROJECT IS FUNDED BY THE LIFE PROGRAMME FROM THE EUROPEAN UNION



NATIONAL CENTRE FOR SCIENTIFIC RESEARCH



NATIONAL INSTITUTE FOR HEALTH AND WELFARE

LIFE INDEX-AIR – REACHING OUR GOALS

Welcome to the fifth newsletter of our project – LIFE INDEX-AIR!

At this moment, we are getting closer and closer to the final phase of our project.

One of the goals of the LIFE Index-Air project was to develop an innovative and versatile decision support tool for policy makers to help them identify measures to improve air quality and quantitatively assess their impact on the health and well-being of the population. In this newsletter, we will provide an overview of the LIFE Index-Air tool that was already created and how it works.

This newsletter will also provide some highlights of activities that LIFE Index-Air promoted or participated, some news about recently published papers and to present to you some more of the great team members of our project that allowed to develop and implement it!

Always remember...

The air belongs to everyone!



TO KNOW MORE ABOUT OUR PROJECT

We invite you to follow us through our website and facebook!

www.lifeindexair.net
www.facebook.com/LIFEIndexAir

If you have any questions or comments about our work or our future plans, don't hesitate to get in touch.

IMPLEMENTATION OF THE LIFE INDEX-AIR EXPOSURE - DOSE MANAGEMENT TOOL IN 5 EUROPEAN CITIES

BACKGROUND

Exposure to particulate matter (PM) has been associated with significant adverse health effects. The most recent EEA report about Air Quality in Europe (EEA, 2020) shows that at 70 % of the stations, located in 29 of the 33 reporting countries, PM_{2.5} annual concentrations exceed the respective WHO Air Quality Guideline (10 µg/m³).

Given the current state of urban air quality, the legislative European framework obliges the Member States to design air quality plans (AQP) and encourage the involvement of local authorities and stakeholders in order to meet the air quality standards. The majority of the AQP mainly consider the impact of emission abatement measures on ambient air quality. The use of Air Quality models, with monitored data, is viewed as the best currently available approach to understand the response of the atmosphere to different air pollution control measures, providing essential information on the maximum feasible air quality improvement. However, the link between the resulting air quality state and its consequences for health and related cost-efficiency analysis are often neglected. Therefore, there is a need for better result-oriented AQPs.

LIFE INDEX-AIR STRATEGY

Lisbon (Portugal) was chosen as the pilot city where assessment of children exposure to PM was conducted. PM was sampled inside 5 schools, 40 homes and 4 transport modes and in the outdoor environments. Time-activity pattern records showed that children spent 86% of their time indoors, especially at home and in the classroom.

The PM_{2.5} and PM₁₀ concentrations in classrooms (35.3 µg/m³ and 65.4 µg/m³, respectively) were more than double than in homes (14.5 µg/m³ and 18.2 µg/m³, respectively) and highly exceeded the limit values established by the Portuguese legislation.

BUILDING THE TOOL AND ITS IMPLEMENTATION

The LIFE Index-Air project developed a novel policy support tool, based on an integrated exposure – dose – burden of disease assessment. The developed tool was implemented in five European cities: Lisbon and Porto (Portugal), Treviso (Italy), Athens (Greece) and Kuopio (Finland).

LIFE INDEX-AIR CITIES



LIFE INDEX-AIR TOOL – HOW IT WORKS?

The **LIFE Index-Air tool** provides:

- 1) Modelling of ambient concentrations based on PM emissions
- 2) Exposure modelling for the assessment of population exposure
- 3) Dosimetry modelling for the assessment of respiratory deposition and internal doses
- 4) Burden of disease (BoD) methodology for estimating the health impacts
- 5) Built-up of policy making scenarios

An overview video about the tool was made available at the LIFE Index-Air’s Youtube channel with a step-by-step guide, explanations through all the process and which outcomes are possible with this tool.

Check the video [here!](#)



Video with step by step guide of how to use the LIFE Index-Air tool (available in Youtube)

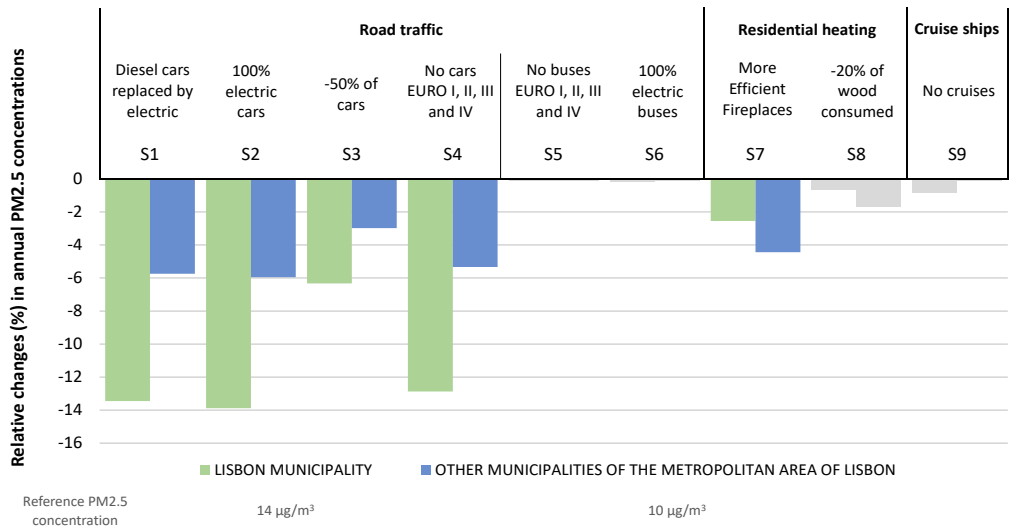
RESULTS OF THE LIFE INDEX-AIR TOOL

Three packages of measures can be tested focusing on:

- 1) **traffic** (changes in the number of vehicles and in the percentage of vehicles with respect to fuel and vehicle emission standard)
- 2) **residential heating** (changes in the quantity of wood burnt and in the type of equipment used)
- 3) **shipping** (changes in the number of cruise ships)

The tool allows the user to quantitatively measure the impact of the selected strategies not only on **PM10 and PM2.5 concentration levels**, but also on the **population exposure, dose deposited to the human organism**, and **related burden of disease**.

EXAMPLE – LIFE INDEX-AIR TOOL APPLIED TO LISBON, PORTUGAL



Estimation of LIFE Index-Air tool regarding the reduction of PM2.5 concentration in Lisbon for 9 different scenarios

LIFE INDEX-AIR TOOL APPLIED TO LISBON, PORTUGAL

Evaluating 9 different scenarios (S) at Lisbon, the LIFE Index-Air indicates that the reduction of population exposure to PM2.5 for the different scenarios can avoid annually up to:

- **200** deaths (S1, S2 and S4)
- **6000** disability adjusted life years (S2)
- **3000** years of life lost due to premature mortality (S1, S2 and S4)
- **2000** disability weighted years lived with disabilities (S1, S2 and S4)

ACTIVITIES OF LIFE INDEX-AIR TARGETING DIFFERENT AUDIENCES

WORKSHOP “THE AIR THAT I BREATHE... INDOORS” WITH 350 PORTUGUESE TEACHERS

Last 22nd February 2021, Marta Almeida, coordinator of LIFE Index-Air, provided the online workshop entitled “The air that I breathe... Indoors”, which was an initiative of the project “The air that I breathe” that is promoted by ABAE (responsible by Eco-Schools in Portugal).



This workshop targeted the teachers of the Portuguese Eco-Schools and a total of 350 teachers participated in it. This means that this event had great potential of know-how transfer to students.

Moreover, the workshop was displayed online (in the [Youtube page](#) of ABAE) and it has already more than 7000 visualizations.

LIFE INDEX-AIR TOOL PRESENTED AT VIII FÓRUM REDE PORTUGUESA DE MUNICÍPIOS SAUDÁVEIS

LIFE Index-Air tool was presented by Marta Almeida to around of 100 participants that were representatives of 32 Portuguese Municipalities in the Webinar “Ecology and Health”. This event was promoted by the VIII Fórum Rede Portuguesa de Municípios Saudáveis and took place online last 19th march 2021.

The presentation was entitled “LIFE Index Air Tool, a decision support t to reduce the population exposure to atmospheric particles”. This was an excellent opportunity to explain LIFE Index-Air tool and how it works to potential end-users.

MEET THE TEAM

Each newsletter features profiles of collaborators from our five partner organizations.



HÉLDER RELVAS

Researcher at the CESAM, University of Aveiro
Aveiro, Portugal

Helder Relvas is a Researcher at the Centre for Environmental and Marine Studies (CESAM) and the Department of Environment and Planning of the University of Aveiro. He holds a PhD in Environmental Sciences and Engineering. The focus of his research work is air quality management, application of atmospheric dispersion models, estimation of air pollution health impacts, and the development and implementation of decision support tools to identify measures to improve air quality. He is already the author of more than 20 scientific papers and has participated in several national and international research projects.

"I grew up in a small village surrounded by nature, for that reason the environment protection, health, and wellbeing, has always been my interest and motivation in my professional trajectory. Air pollution is a current concern due to the adverse effects it causes on human health. The LIFE Index-Air project gave me the chance to get involved directly in the development of a new tool able to support decision-makers in the definition of air pollution control strategies. Furthermore, the web-based tool can also be used to fostering citizen's responsibility and awareness on air quality. The tool includes five case studies, this is important because people tend to be more willing to engage in pro-environmental behavior when the environmental issues become proximal to them. I believe that a more informed population is essential to modify behaviors and to contribute to improving air quality."



VÂNIA MARTINS

Researcher at C²TN, Instituto Superior Técnico,
Universidade de Lisboa
Lisbon, Portugal

Vânia Martins is a researcher at Center for Nuclear Sciences and Technologies (C2TN) of the Instituto Superior Técnico (IST). She holds a PhD in Environmental Analytical Chemistry at University of Barcelona. She is member of the operational team of LIFE Index-Air project, being responsible for the coordination and accomplishment of the technical activities of the IST. Her research work is focused on the assessment of the population exposure to atmospheric aerosols in indoor and outdoor environments. She has been actively involved in actions to raise awareness of the population to the air pollution problem.

"When I was a little girl, I wanted to be a doctor or nurse to take care of people's health. Nowadays, I find those childhood wishes fulfilled with my work since I feel that I can act to prevent the health effects caused by air pollution. According to World Health Organization, air pollution is now considered to be the world's largest environmental health threat. To understand the best way to develop solutions, it is important to better understand this invisible threat. In the framework of the LIFE Index-Air project, I was involved in an intensive work of monitorization of air quality and evaluation of the population exposure to air pollutants. With the knowledge obtained, a decision support tool was developed. This tool aims to define priorities and guide abatement strategies that reduce air pollution exposure and related diseases and deaths. Moreover, public awareness actions are essential to stimulate the public to limit their exposure to air pollutants and reduce their air pollution footprint by adopting environmentally conscious actions."

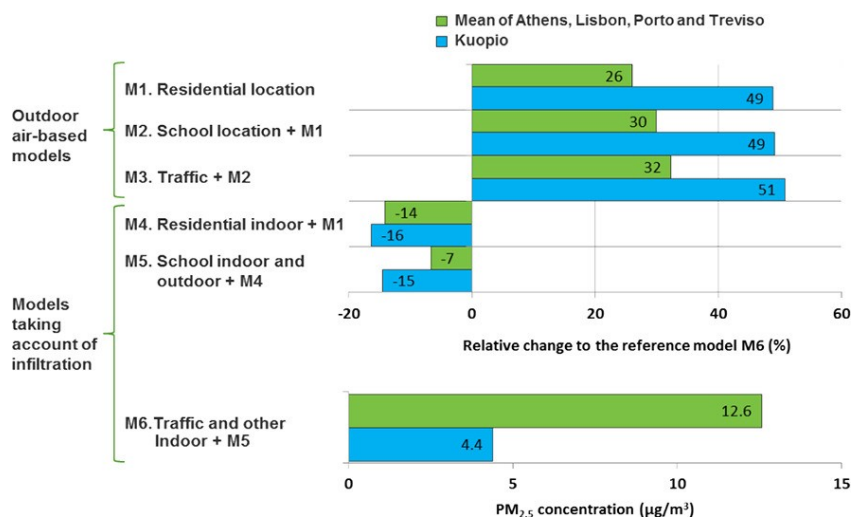
NEW SCIENTIFIC ARTICLES WITHIN THE FRAMEWORK OF LIFE INDEX-AIR

Analysis of spatial factors, time-activity and infiltration on outdoor generated PM2.5 exposures of school children in five European cities

Authors: A. Korhonen, H. Relvas, A.I. Miranda, J. Ferreira, D. Lopes, S. Rafael, S.M. Almeida, T. Faria, V. Martins, N. Canha, E. Diapouli, K. Eleftheriadis, E. Chalvatzaki, M. Lazaridis, H. Lehtomäki, I. Rumrich, O. Hänninen

Abstract: Atmospheric particles are a major environmental health risk. Assessments of air pollution related health burden are often based on outdoor concentrations estimated at residential locations, ignoring spatial mobility, time-activity patterns, and indoor exposures. The aim of this work is to quantify impacts of these factors on outdoor-originated fine particle exposures of school children. We apply nested WRF-CAMx modelling of PM2.5 concentrations, gridded population, and school location data. Infiltration and enrichment factors were collected and applied to Athens, Kuopio, Lisbon, Porto, and Treviso. Exposures of school children were calculated for residential and school outdoor and indoor, other indoor, and traffic microenvironments. Combined with time-activity patterns six exposure models were created. Model complexity was increased incrementally starting from residential and school outdoor exposures. Even though levels in traffic and outdoors were considerably higher, 80–84% of the exposure to outdoor particles occurred in indoor environments. The simplest and also commonly used approach of using residential outdoor concentrations as population exposure descriptor (model 1), led on average to 26% higher estimates (15.7 µg/m3) compared with the most complex model (# 6) including home and school outdoor and indoor, other indoor and traffic microenvironments (12.5 µg/m3). These results emphasize the importance of including spatial mobility, time-activity and infiltration to reduce bias in exposure estimates.

Type of publication: Scientific article published at **Science of The Total Environment**



How to cite: A. Korhonen, H. Relvas, A.I. Miranda, J. Ferreira, D. Lopes, S. Rafael, S.M. Almeida, T. Faria, V. Martins, N. Canha, E. Diapouli, K. Eleftheriadis, E. Chalvatzaki, M. Lazaridis, H. Lehtomäki, I. Rumrich, O. Hänninen (2021) Analysis of spatial factors, time-activity and infiltration on outdoor generated PM2.5 exposures of school children in five European cities. Science of The Total Environment 785, 147111. DOI: [10.1016/j.scitotenv.2021.147111](https://doi.org/10.1016/j.scitotenv.2021.147111)

Assessment of the Personal Dose Received by School Children due to PM10 Air Pollution in Lisbon

Authors: E. Chalvatzaki, S.E. Chatoutsidou, V. Martins, T. Faria, E. Diapouli, M. Manousakas, S.M. Almeida, K. Eleftheriadis, M. Lazaridis

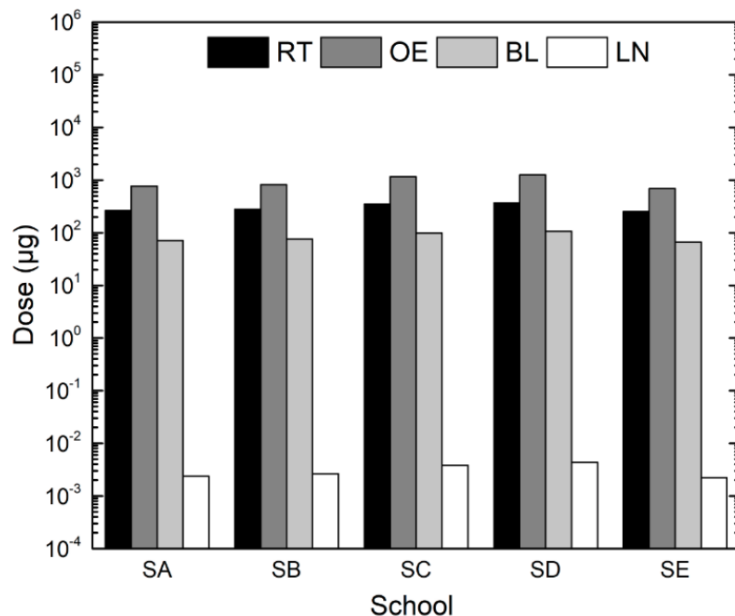
Abstract: Investigation of the personal dose caused by air pollution in children is important due to their vulnerability. Exposure to PM10 and its components, particularly certain metals, may pose significant health risks therefore many studies have focused on measuring the ambient indoor/outdoor PM10 concentrations in school environments. However, little research has aimed at assessing the resultant personal dose.

Hence, this study applied a dosimetry model (ExDoM2) to predict the personal dose received by students in five primary schools in Lisbon, Portugal. The calculations were performed for PM10 and PM10-bound metals, and the exposed subjects were assumed to be 10-year-old nose breathers. A realistic exposure scenario involving three different settings (the indoor home, indoor school and outdoor school microenvironments) was implemented for an exposure period of one week (Monday–Sunday).

Although the students spent only 24% of their total time inside a school (vs. 73% at home), this environment contributed 44% on average to the weekly deposited dose of PM10, providing further evidence that indoor exposure at schools is a major contributor to the total dose. The modeling results showed that the cumulative deposited doses in the respiratory tract (RT) reached as high as 2,004 μg , 0.16 μg , 0.65 μg , 0.58 μg and 0.06 μg for PM10, Cr, Mn, Pb and Ni, respectively, after one week.

Type of publication: Scientific article published at **Aerosol and Air Quality Research**

Figure. Retention of PM10 in the respiratory tract (RT) and mass transferred to the oesophagus (OE), lymph nodes (LN) and absorbed into the blood (BL) for each school.



How to cite: E. Chalvatzaki, S.E. Chatoutsidou, V. Martins, T. Faria, E. Diapouli, M. Manousakas, S.M. Almeida, K. Eleftheriadis, M. Lazaridis (2020) Assessment of the Personal Dose Received by School Children due to PM10 Air Pollution in Lisbon. *Aerosol and Air Quality Research* 20, 1384-1397.

DOI: [10.4209/aaqr.2020.01.0022](https://doi.org/10.4209/aaqr.2020.01.0022)

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KEEP IN TOUCH

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