LIFE INDEX-AIR:
Development of an Integrated Exposure – Dose Management Tool for Reduction of Particulate Matter in Air

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LIFE ΚΑΙ ΠΟΛΕΙΣ Διημερίδα Ενημέρωσης, 10-11 Απριλίου 2019

LIFE Programme : EU's financial instrument supporting environmental and nature conservation **projects** throughout the EU

LIFE15 ENV/PT/000674

- **Total Budget:** 1,369,071 €
- **EU contribution**: 792,401 € (cofunding: 58,6%)
- **Start / End of project :** 1st Oct. 2016 / 31st March 2020
- **Theme :** Environment and Health

Project's Partners:

TÉCNICO LISBOA	**Instituto Superior Técnico, Portugal**
ΔΗΜΟΚΡΙΤΟΣ	**NCSR "Demokritos"**
	National Institute for Health and Welfare
	Technical University of Crete
universidade de aveiro	**Universidade de Aveiro**

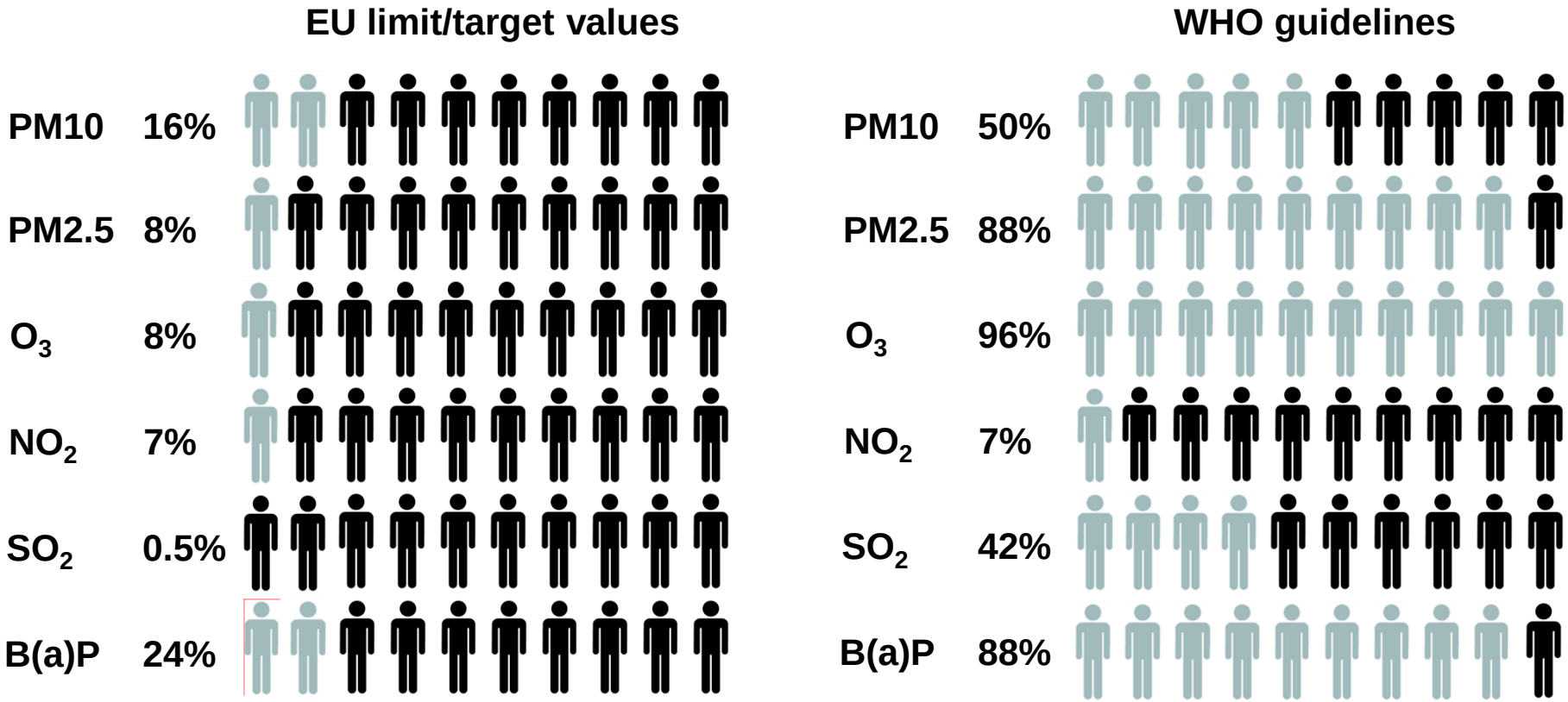
ADVISORY BOARD

Country	Institution
Portugal	• Portuguese Environment Agency • Portuguese Health General Directorate • Lisbon Regional Coordination and Development Comission
Finland	• City of Kuopio
Greece	• **Association for Sustainable Development of Cities** • **Greek Ministry of Health**
Italy	• Regional Agency for Environmental Protection and Prevention of the Venice

Other interested bodies:

Country	Institutions
Portugal	• North Regional Coordination and Development Comission
Greece	• **Environment & Energy Ministry**

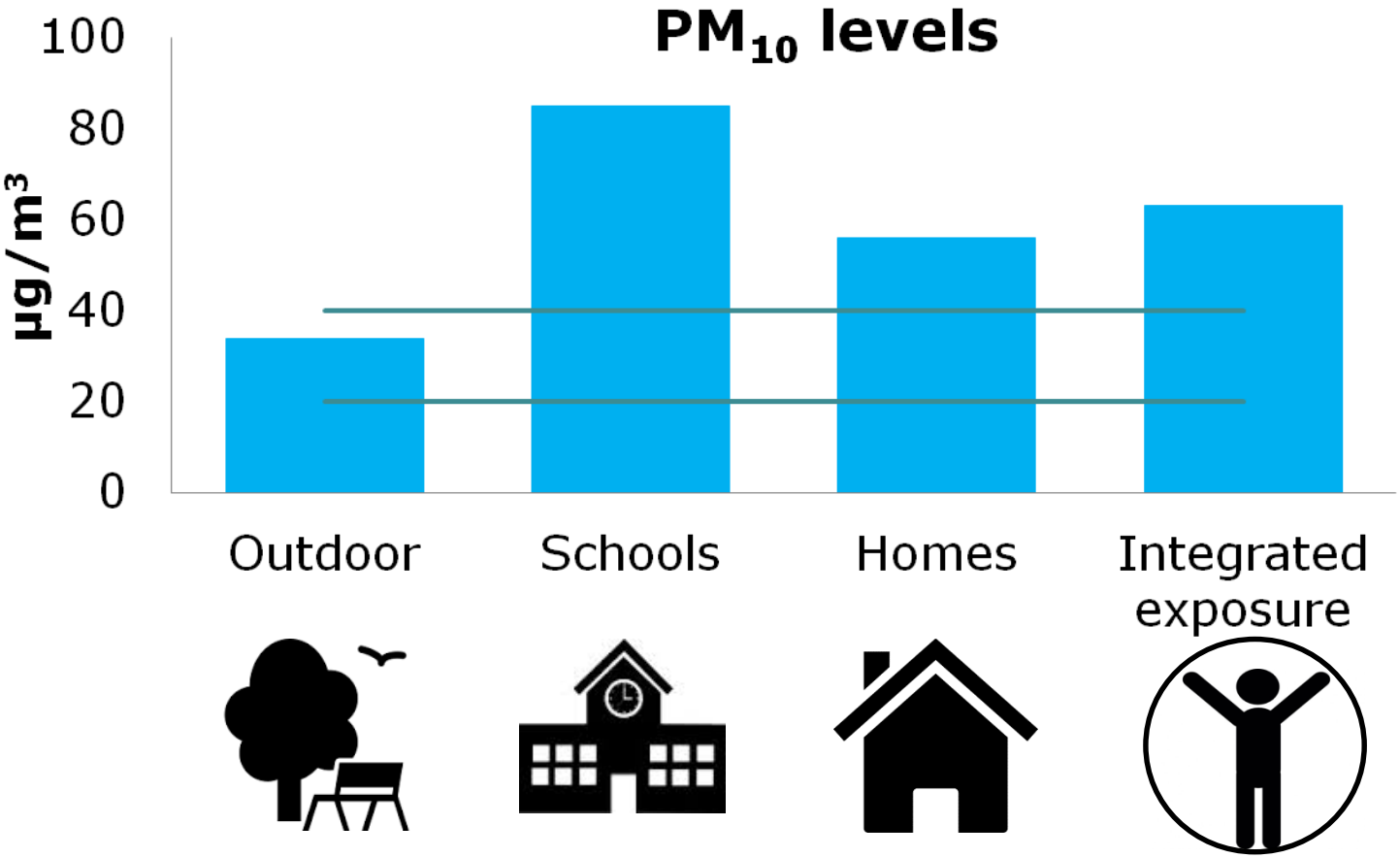
Motivation:



Round 90 % of Europeans living in cities are exposed to levels of air pollutants deemed damaging to health by the World Health Organization's more stringent guidelines.

Air Quality in Europe – 2016 Report,EEA Report | No 28/2016

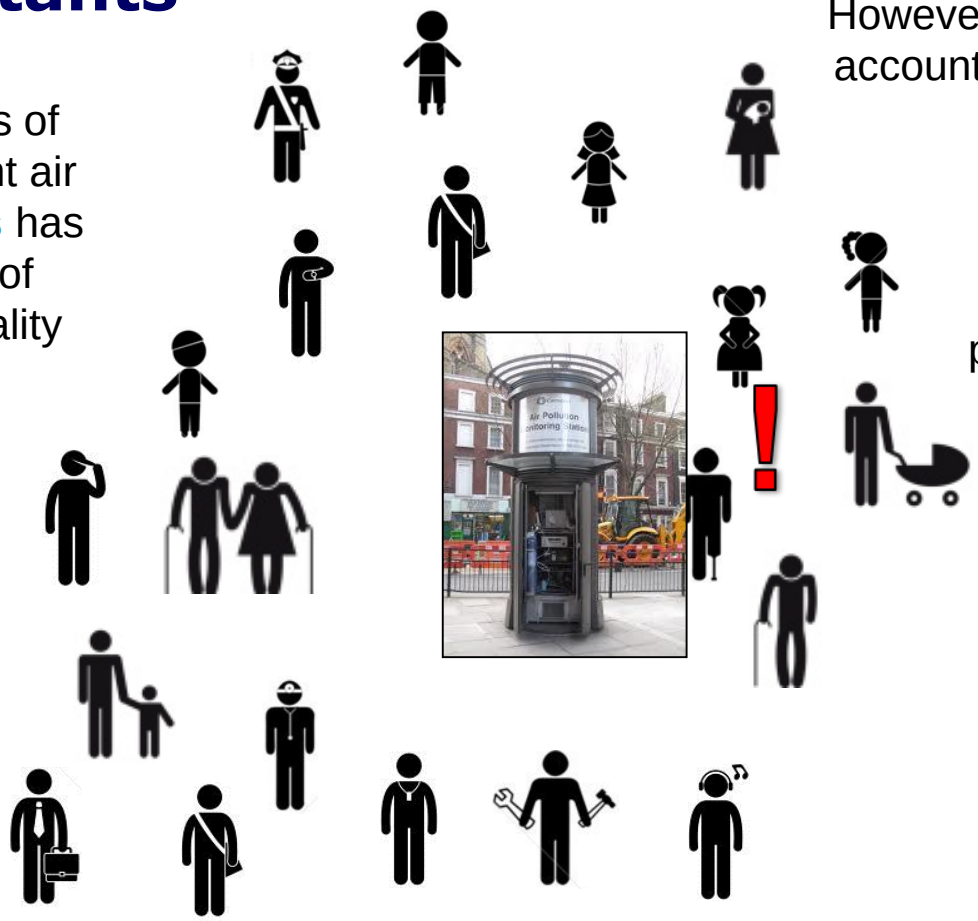
Motivation: Assessment of human exposure to air pollutants



Motivation: Assessment of human exposure to air pollutants

Measuring outdoor levels of particles at **fixed** ambient air quality **monitoring sites** has been the traditional way of **evaluating** urban air quality

This fixed monitoring stations are supposed to assess the exposure of all the population to particles



However, this approach **fails** to account for **all components** of exposure

1st : There is a huge **heterogeneity** in the **concentrations** of pollutants within the city

2nd : People spend more than **90% of the time indoors**

3rd : There is a huge **heterogeneity** in **time** activity patterns of the population

This brings the considerable importance of assessing the **personal integrated exposure** to particles as it is the key determinant of the **dose received by an individual** and thus directly influences the **health impacts.**

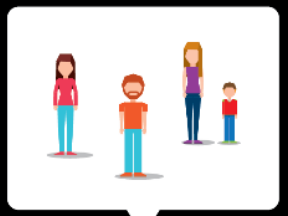
What is the LIFE Index-Air Project?

Development of an innovative and versatile **decision support tool for policy makers** that will help them identify measures to improve air quality and quantitatively assess their impact on the health and well-being of the population.

Group Target : Children between 6 -12 years old

Implementation cities:
Lisbon, Porto, Athens, Treviso, Kuopio

EMISSIONS ▶ DISPERSION ▶ INFILTRATION ▶ PHISICAL ACTIVITY ▶ DOSE ▶ HEALTH EFFECTS



SOURCES

AIR QUALITY MODULE ▶ EXPOSURE MODULE ▶ DOSIMETRY MODULE ▶ BURDEN DISEASE MODULE

IDENTIFY ACTIONS TO IMPROVE AIR QUALITY AND HEALTH

ASSESS AIR QUALITY IN EUROPEAN CITIES

CALCULATE THE POPULATION EXPOSURE TO ATMOSPHERIC PARTICLES

QUANTIFY THE INHALED DOSE OF ATMOSPHERIC PARTICLES

EVALUATE THE EFFECTS OF THE PARTICLES IN HUMAN HEALTH

IMPLEMENTATION OF THE TOOL IN 5 EUROPEAN CITIES
LISBON, OPORTO, ATHENS, KUOPIO AND TREVISO

DEVELOPMENT OF GUIDELINES FOR ACTION PLANS FORMULATION

OPERATIONAL TOOL DESIGN

1. **Design an operational platform…**

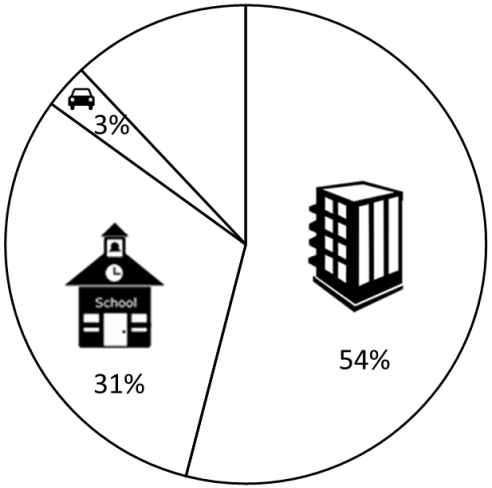
   … based on the requirements of 4 separate modules

   - Database on chemical constituents of PM2.5 and PM10 sampled indoors and outdoors of EU cities & time-activity data
   - Exposure assessment system
   - Operational platform for PM dose calculation
   - A platform for health impact assessment

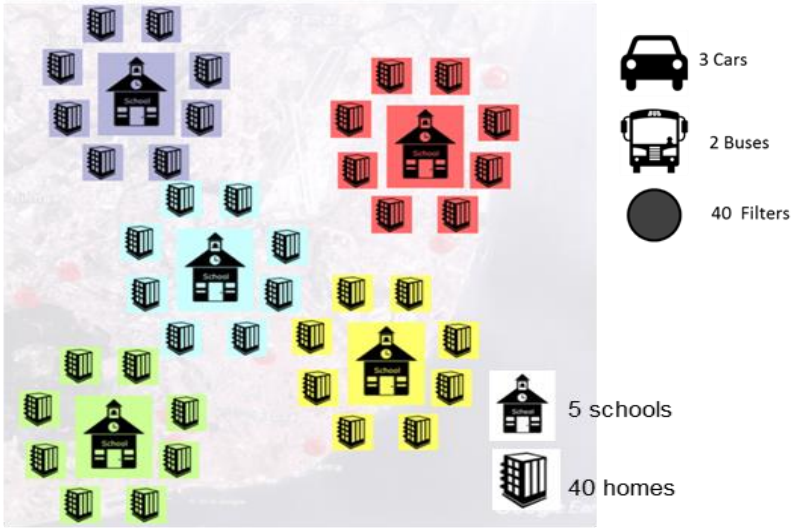
2. **Coupling and incorporation of each module in an integrated operational tool**

1st module: AIR QUALITY MODULE

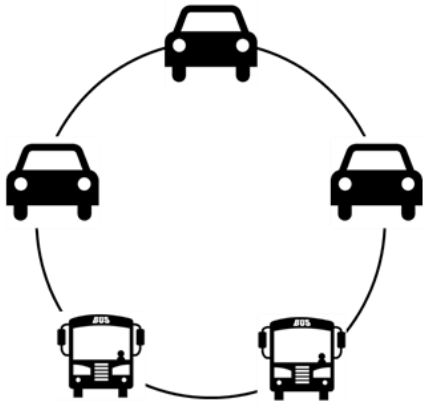
1. Time Activity Pattern



2. Concentrations of PM in schools and homes



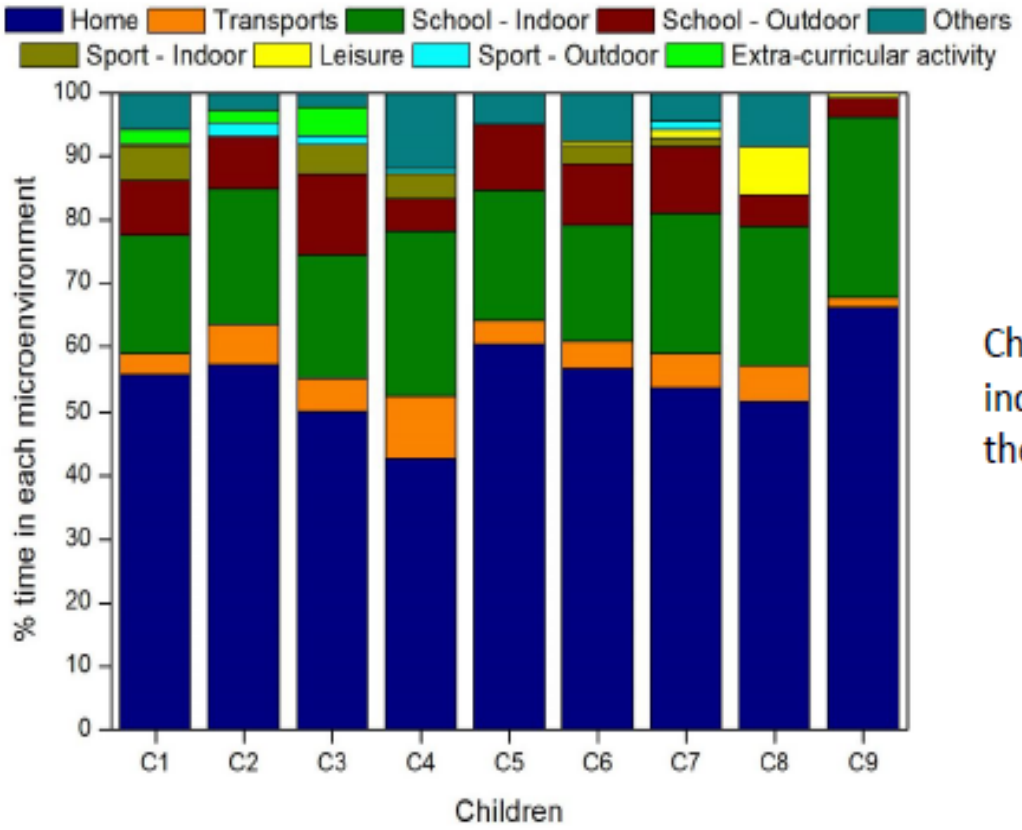
3. Concentrations of PM in transports

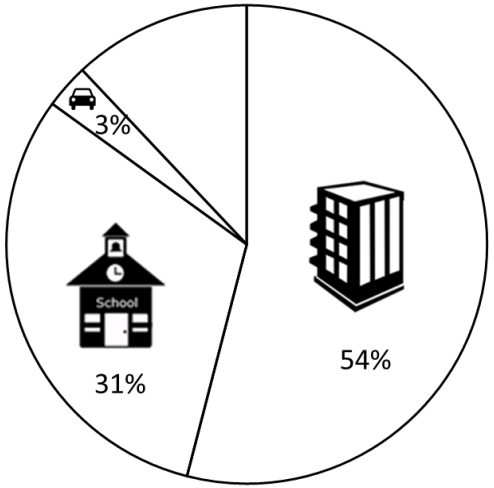


PM2.5 + PM10 + Elements (As + Cd + Ni + Pb) + PAHs (BaP) + EC/OC

DATABASE CREATION

1st module: AIR QUALITY MODULE





Children spent most of their time indoors indicating that risk assessment should focus on these microenvironments.

1st module: AIR QUALITY MODULE

Equipment

Personal Environmental Monitor (PEM) **PM2.5 and PM10 samples collection**

Micro-aethalometer AE51 (Black Carbon)

Condensation Particle Counter 3007 (PN: 0.01-1µm)

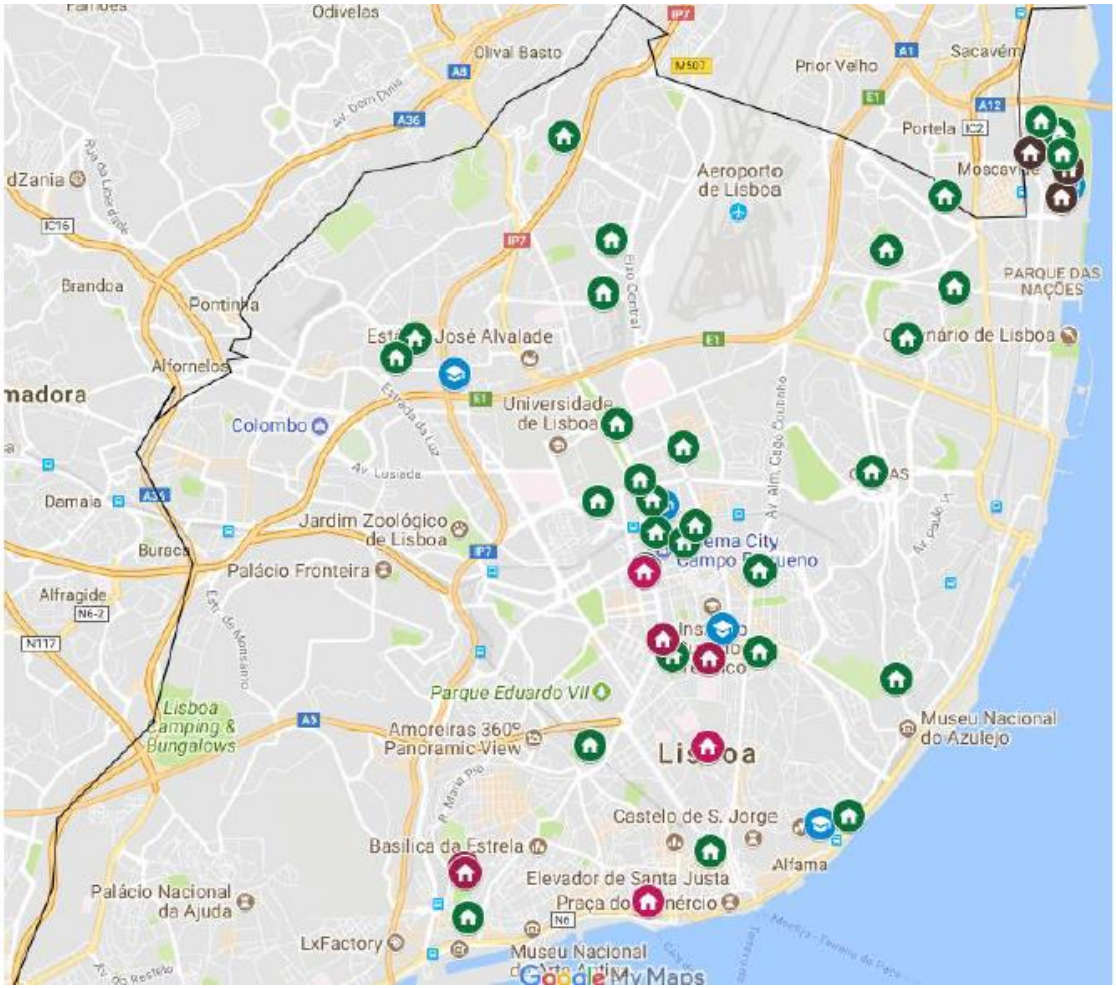
SidePak AM520 (PM2.5)

Indoor Air Quality analyser (CO_2, CO, T, RH)

GPS

Real-time measurements

1st module: AIR QUALITY MODULE

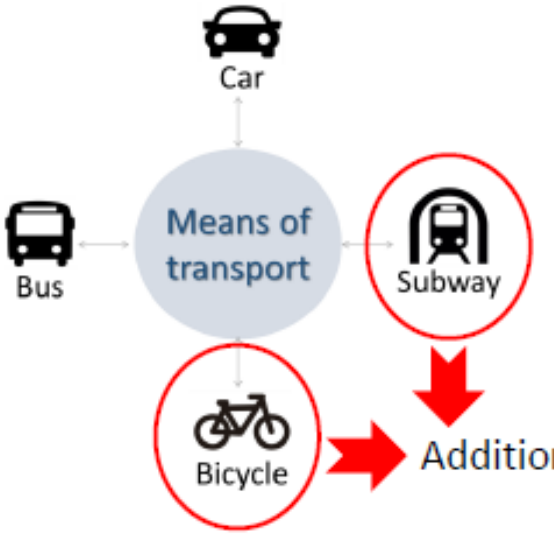


LIFEINDEXAIR

PROJECT FUNDED BY EUROPEAN UNION

- 33 homes
- 5 schools

- Four transportation modes:



Additional to the LIFE Index Air proposal

Indoor measurements

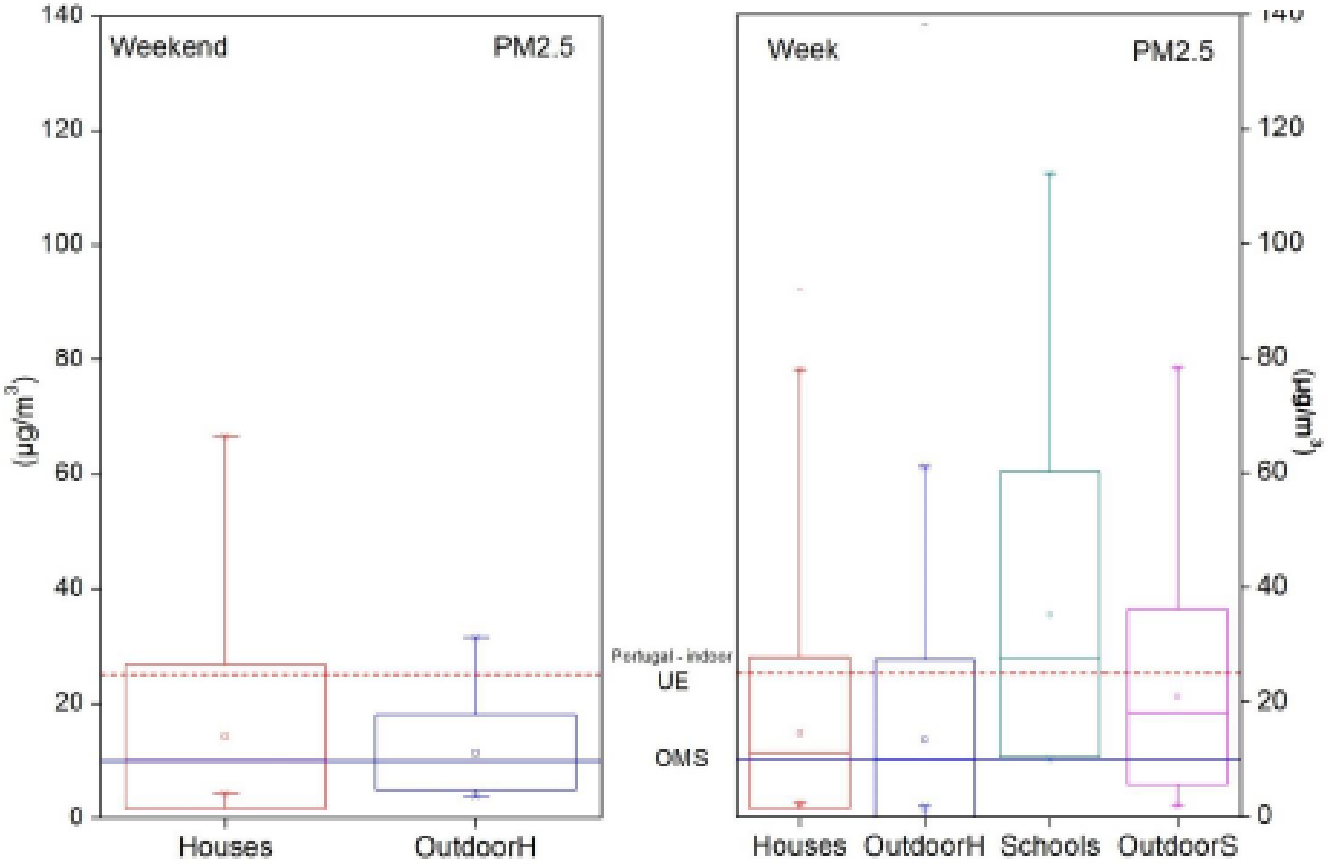
Outdoor measurements

Metro

Bicycle

1st module: AIR QUALITY MODULE

PM2.5



2nd module: EXPOSURE MODULE

Dispersion and exposure models, for the assessment of population and individual exposure

Meteorological model

+

Emission Inventories

Dispersion model

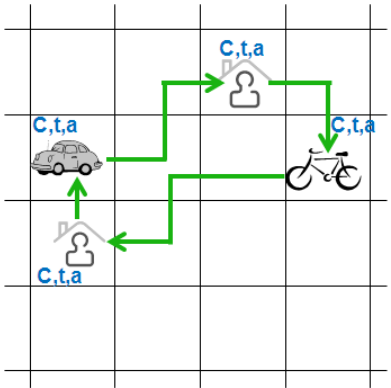
Time-Activity Data

Surface gridded PM concentration (1x1km, 1 hour)

I/O ratios

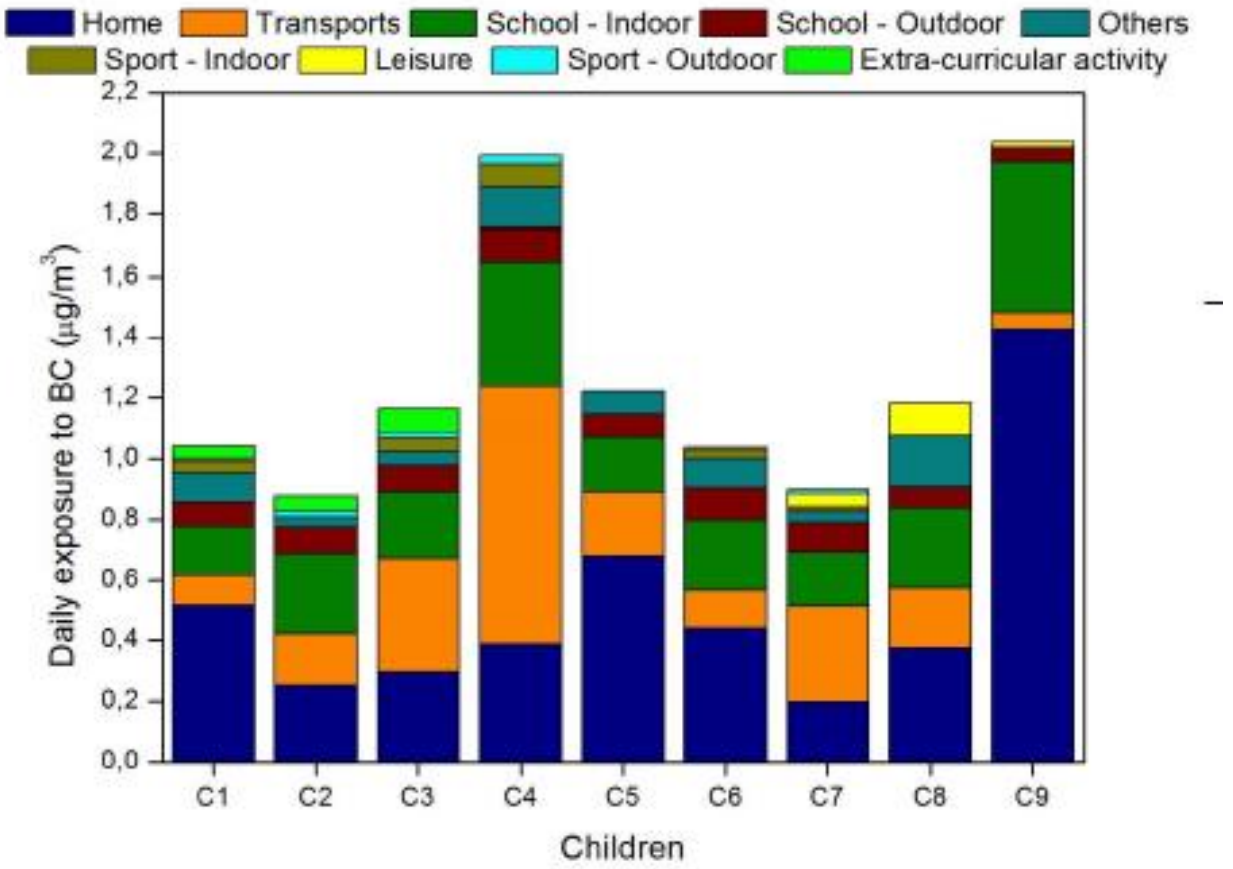
$$E = \frac{1}{T} \cdot \sum_j \int C_j \cdot dt_j$$

C: concentration
t: time
a: activity



2nd module: EXPOSURE MODULE

Daily exposure to BC



3rd module: DOSIMETRY MODULE

Assessment of respiratory deposition and internal doses

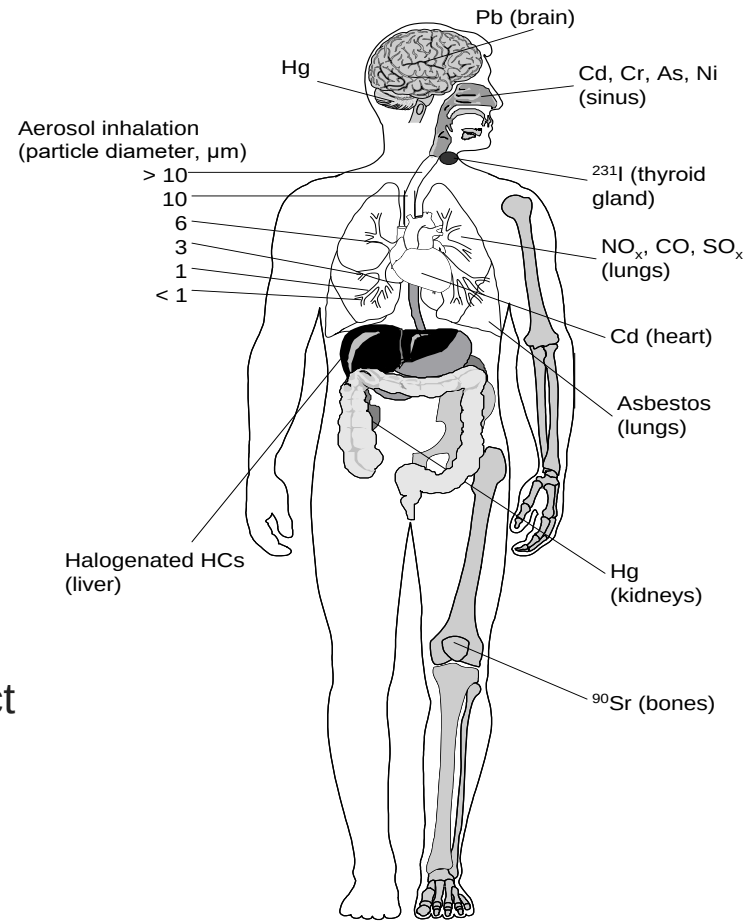
The Physiologically-Based PharmacoKinetic (PBPK) model :

simulate the time course of absorption, distribution, metabolism and excretion of chemicals that enter the body.

Most PBPK models are multi-compartment (organs or tissues) for which the interconnections correspond to blood flow.

Detailed dose calculations for individual human subjects :

- Deposition of PM depending on their chemical composition and size distribution
- The retention of particles in the human respiratory tract
- Transport to the gastrointestinal tract and blood



4th module : BURDEN OF DISEASE MODULE

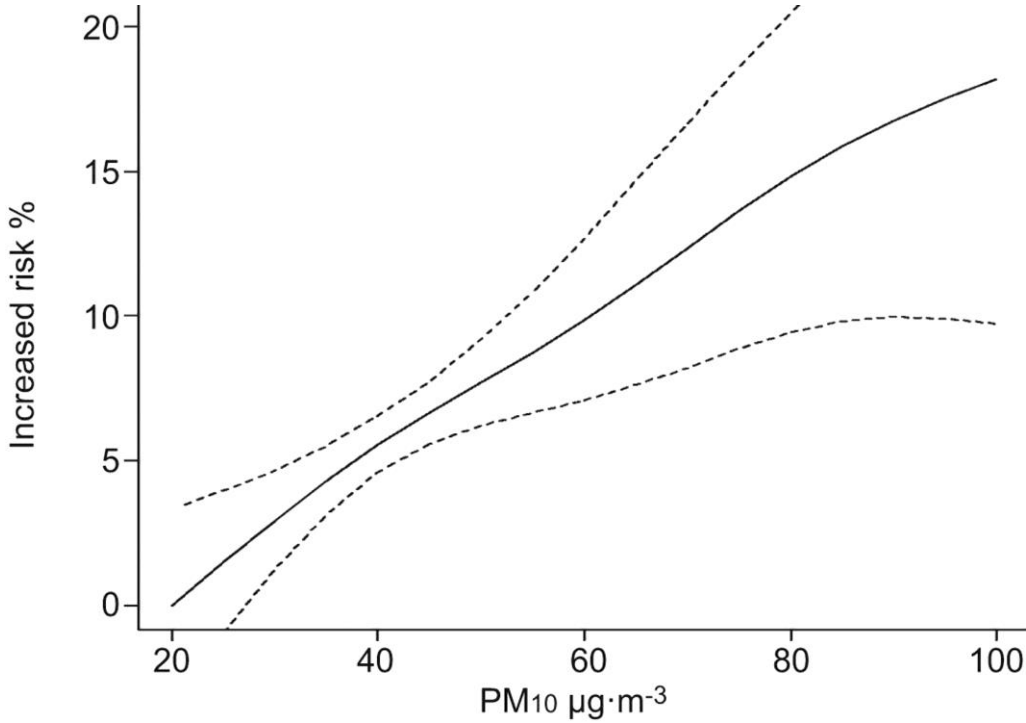
Assessment of respiratory deposition and internal doses

1.Identification of health endpoints
    Determination of E-R functions (shape, parameters)

2.Background burden of disease
    Geographical scales (municipality – region – national)

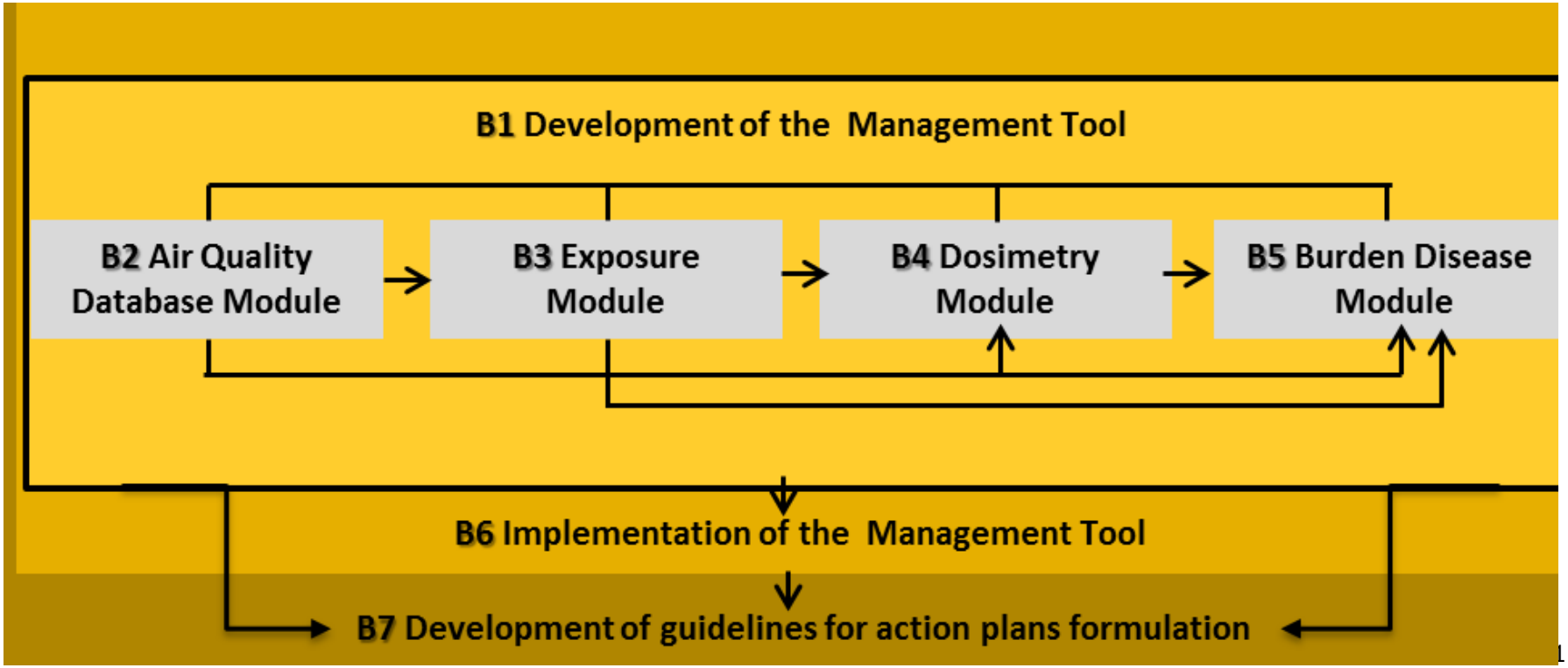
3.Population attributable fractions
    Age standardization/scaling

4.Quantification
    nr of cases, deaths, years of life lost, years lived with disability
    visualization, comparisons, reduction potential,



MODULES COUPLING: Development of a versatile and long-term, decision-making tool

Complex software application to be developed: The operational platform will include a large amount of information as well as different models



MODULES COUPLING: Development of a versatile and long-term, decision-making tool

DESIGN OF OPERATIONAL PLATFORM:

- User-friendly and interactive software environment
- Addressed to non-scientific audiences
- Analysis of available data & Application of specialized models

1st Menu DATA	2nd Menu GRAPHING	3rd Menu Scenario Build-up
• Load Data • Browse Data • …	• Technical Graphing • Data Analysis • Save Image	• Individual exposure forecast • Burden of disease • …

Dissemination :
helping citizens to get involved

•Communication activities to the general public and to those stakeholders that could usefully benefit from the project's experience.

•**LIFE Index-Air** monitoring campaigns and awareness activities are being performed in primary schools from Lisbon (more than 25 schools, 6000 children)

Awareness campaign for 200 students from Escola João de Deus, Lisbon

Activities, Awareness campaign - By lifeindoair - March 17, 2017

Place: School João de Deus

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 220 students from EB1 Catela Gomes, Lisbon

Activities, Awareness campaign - By lifeindoair - March 16, 2017

Place: School EB1 Catela Gomes

Objective: Awareness campaign about air quality and presentation of the challenge "O ar è de todos"

Partner: IST

Awareness campaign for 200 students from Externato JoãoXXIII, Lisbon

Activities, Awareness campaign - By lifeindoair - March 15, 2017

Place: Externato JoãoXXIII

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 200 students from School EB1 Leão de Arroios, Lisbon

Activities, Awareness campaign - By lifeindoair - March 14, 2017

Place: School EB1 Leão de Arroios

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 25 students from School EB1 Rosa Lobato Faria, Lisbon

Activities, Awareness campaign - By lifeindoair - March 13, 2017

Place: School EB1 Rosa Lobato Faria

Objective: Awareness campaign about air quality and presentation of the challenge "O ar è de todos"

Partner: IST

Awareness campaign for 100 students from School EB1 S. Miguel, Lisbon

Activities, Awareness campaign - By lifeindoair - March 13, 2017

Place: School EB1 S. Miguel

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 25 students from School EB1 Oliveira Marques, Lisbon

Activities, Awareness campaign - By lifeindoair - March 9, 2017

Place: School EB1 Oliveira Marques

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Meeting with Parque das Nações Parish Council, Portugal

Activities, Stakeholder meeting - By lifeindoair - February 16, 2017

Place: Lisbon, Portugal

Objective: present the LIFE Index-Air project to the stakeholder; to seek the stakeholder views in relation to the proposed activities; to discuss the needs of the stakeholder in regard of the tool generated in this project; to plan a timetable for the project actions; to promote the involvement of the stakeholder from the beginning; to obtain the stakeholder support for the implementation of project's actions.

Partner: IST

Meeting with Olivais Parish Council, Portugal

Activities, Stakeholder meeting - By lifeindoair - February 14, 2017

Place: Lisbon, Portugal

Objective: present the LIFE Index-Air project to the stakeholder; to seek the stakeholder views in relation to the proposed activities; to

European Commission

Awareness campaign for 136 students from Externato Primário da Associação Pró-Infância Santo António de Lisboa, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: Externato Primário da Associação Pró-Infância Santo António de Lisboa (Arroios, Lisbon)

Objective: Awareness campaign about air quality and presentation of the challenge "The air belongs to everyone"

Partner: IST

Awareness campaign for 264 students from School EB1Convento do Desagravo, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: School EB1 Convento do Desagravo (São Vicente, Lisbon)

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 325 students from School EB1 Portela, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: School EB1 Portela (Portela, Lisbon)

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 75 students from School EB1 dos Coruchéus, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: School EB1 dos Coruchéus (Alvalade, Lisbon)

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 100 students from School JI João de Deus – Estrela, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: School JI João de Deus - Estrela (Estrela, Lisbon)

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 100 students from School EB1 São Miguel, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: School EB1 São Miguel

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 290 students from School EB1 Telheiras, Lisbon

Activities, Awareness campaign - By lifeindoair - March 21, 2017

Place: EB1 Telheiras

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 150 students from Colégio Valsassina, Lisbon

Activities, Awareness campaign - By lifeindoair - March 23, 2017

Place: Colégio Valsassina

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

Awareness campaign for 125 students from School EB1 Leão de Arroios, Lisbon

Activities, Awareness campaign - By lifeindoair - May 19, 2017

Place: School EB1 Leão de Arroios (Arroios, Lisbon)

Objective: Awareness campaign about air quality and presentation of the challenge "O ar é de todos"

Partner: IST

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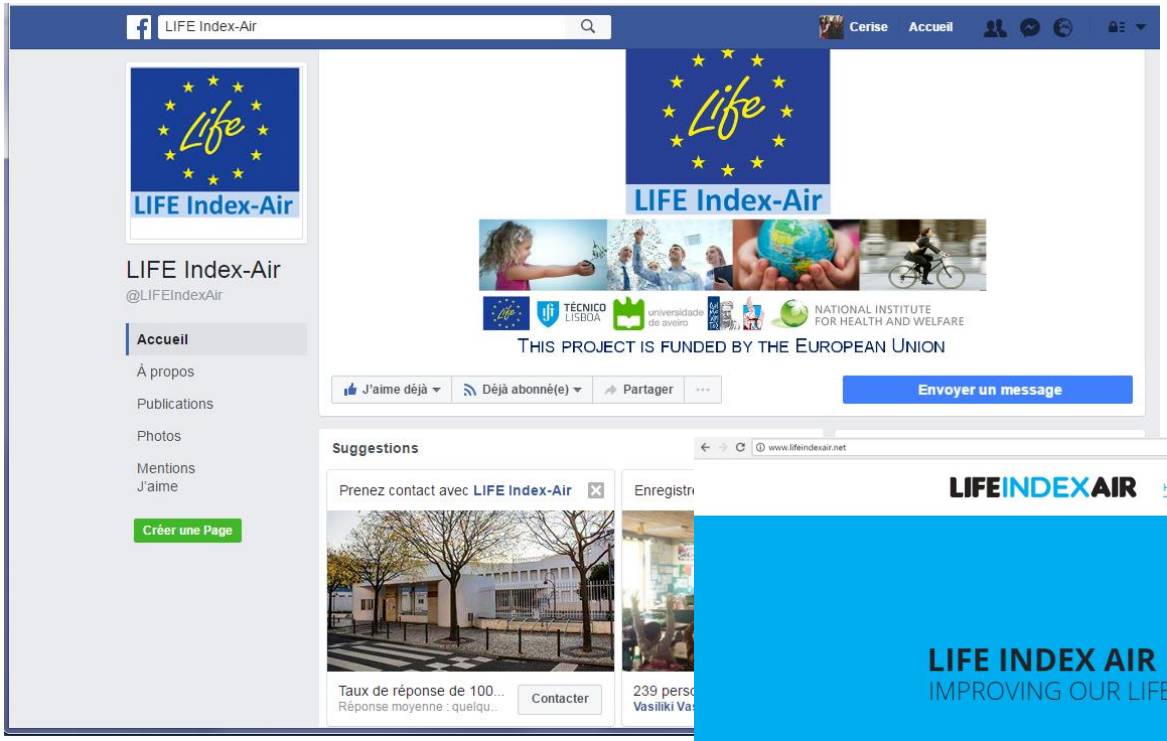
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Taux de réponse de 100...
Réponse moyenne : quelqu...
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LIFEINDEXAIR
O AR É DE TODOS
CALCULAR A EXPOSIÇÃO DA POPULAÇÃO A PARTÍCULAS ATMOSFÉRICAS
QUANTIFICAR A DOSE DE PARTÍCULAS ATMOSFÉRICAS INALADAS
AVALIAR OS EFEITOS DAS PARTÍCULAS NA SAÚDE HUMANA
IDENTIFICAR AÇÕES DE MELHORIA DA QUALIDADE DO AR E SAÚDE
ENVOLVER A POPULAÇÃO NA TOMADA DE AÇÃO
IMPLEMENTAÇÃO DO LIFE INDEX AIR EM 5 CIDADES EUROPEIAS
LISBOA, PORTO, ATENAS, KUOPIO E TREVISO
ESTE PROJETO É FINANCIADO PELO PROGRAMA LIFE DA UNIÃO EUROPEIA


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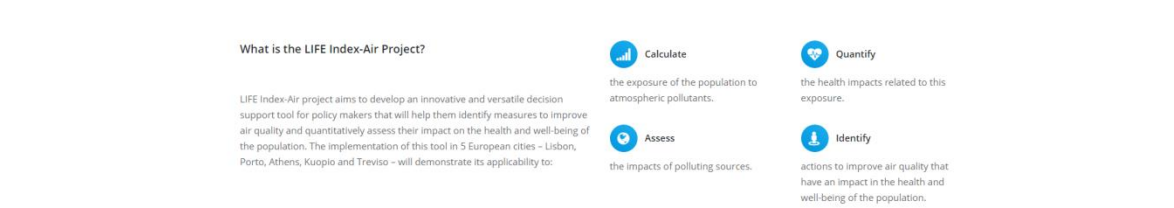
What is the LIFE Index-Air Project?
LIFE Index-Air project aims to develop an innovative and versatile decision support tool for policy makers that will help them identify measures to improve air quality and quantitatively assess their impact on the health and well-being of the population. The implementation of this tool in 5 European cities – Lisbon, Porto, Athens, Kuopio and Treviso – will demonstrate its applicability to:
Calculate
the exposure of the population to atmospheric pollutants.
Quantify
the health impacts related to this exposure.
Assess
the impacts of polluting sources.
Identify
actions to improve air quality that have an impact in the health and well-being of the population.