

# AFTER-LIFE COMMUNICATION PLAN

**IMPROVE LIFE**



**Implementing Methodologies and Practices to  
Reduce air pollution Of the subway enVironmEnt**



Co-Funded by European Commission LIFE+Environment Policy and Governance Programme

LIFE13 ENV/ES/000263



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# IMPROVE LIFE PROJECT

IMPROVE LIFE project is a LIFE+ project dealing with improving air quality in the subway environment, increasing our knowledge of the main air pollutant sources and the mechanisms that affect their concentrations in platforms and inside trains, and aiming to formulate a plan for air quality abatement measures that will be applicable to subway systems worldwide.

## **1. OBJECTIVES**

The main intention of the project is to provide to the local and national transport authorities of European countries a scientifically verified list of appropriate measures and strategies aimed at how to reduce concentrations of inhalable particulate matter and identify potentially toxic chemical components in the air found in underground rail systems. In order to achieve this the project has overviewed previous international studies, identified the main pollutant sources and prioritise air pollution mitigation strategies. One of the core tasks has been to work directly with Public Transport authorities, improving their awareness of air quality and encouraging their development of best practice policies designed to improve underground atmospheric conditions.

Specific objectives were:

- *To determine the emission sources and their contribution to air quality in both platforms and trains, identifying those that have potentially higher health risk.*
- *To evaluate the effect of air quality mitigation measures already used in some subway systems worldwide.*

- *To develop and propose to local/national authorities effective air mitigation measures for subway systems.*
- *To assist local transport in the implementation of a Strategic Plan designed to reduce air contamination in subway systems.*
- *To support the use of the effective measures by applying a communication strategy plan.*
- *To act as a catalyst for the allocation of local/national funds allowing implementation of air improvement strategies.*

## **2. PROJECT IMPLEMENTATION**

A key success of the IMPROVE LIFE subway air quality project, based in Barcelona (Spain), has been to create the largest existing publicly available database on subway air quality. This database includes full chemical analyses of rock ballast, catenary materials, electric brushes, and different types of pantographs, brake pads, rails and train wheels. The database is designed to facilitate the development of realistic PM mitigation strategies in underground train systems that will result in cleaner air being breathed by commuters in the station and inside the trains.

To achieve building this database, air quality measurements were carried out in stations with different designs in both new and old lines (stations with both train tracks in the same space, with only one track, with partially open walls separating both tracks). Monitoring campaigns were done a minimum of twice, and at different times of the year, in order to compare changes in variables such as air conditioning ventilation. Complementary measurements of the ambient street aerosol were also made in order to achieve realistic comparisons between outdoor and subway air.

Key points directly relevant to the problem of understanding air pollution underground were grouped into those related to the varying impacts of:

- *tunnel and rail track maintenance work activities;*
- *applying different ventilation on protocols in tunnels, platforms and trains;*
- *station designs and outdoor air infiltration;*
- *contaminants released by the wear of train operational.*

### 3. RESULTS

The main conclusions can be summarized as follows:

- *A majority of subway stations have ambient levels of PM<sub>2.5</sub> higher than the legislated limits demanded for outdoor air.*
- *There is great variation in air quality between different stations and lines. Stations with the best air quality are likely to be larger and/or newer, with good air interchange between outdoor street air, with full length screen doors fitted to all platforms, and with a straight, horizontal trajectory that minimises brake and wheel wear.*
- *Subway air is normally cleaner when the trains are not operating, although dust emissions from tunnel night work typically result in poorer platform air quality at the beginning of daytime train operations.*
- *It is preferable to minimise dust generation later in the night close to the opening of the subway service.*
- *Nano-polymer suppressants applied to ballast were found to be efficient in reducing dust resuspension during ballast laying and tamping, although the effect was variable depending on factors including distance between the platform and work site.*
- *The type of ventilation system operating in the tunnels and station platforms is a key controlling influence on air quality common to subways worldwide:*
  - *The concentration of inhalable particles on platforms can increase dramatically under inappropriate ventilation settings.*
  - *Enhanced impulsion of outside air into the platform can help improve air quality for commuters.*
  - *Enhanced fan extraction can introduce contaminated tunnel air into the platform and thus worsen air quality.*
  - *Strong tunnel fan system is successful in reducing contamination from the tunnel into the platform air.*
- *Platform and train air purifiers have the potential for improving subway air quality but they are still in R&D phase.*
- *Air conditioning, when windows are closed, can reduce PM<sub>2.5</sub> concentrations by 50% inside trains.*
- *Platform screen doors (PSD) have a very noticeable effect in reducing the concentrations of air pollutants from the tunnel into the platform.*

- *Outdoor pollutants can be identified in the air present on subway platforms, thus the quality of outside city air can greatly influence conditions in the subway platforms.*
- *Subway particles are unusually rich in iron and carbon released by friction between moving train parts*
- *The trace element chemistry of moving train parts such as brakes and wheels can be detected in the air breathed on platforms. The air in a given subway line can have its own distinctive chemical signature that in some cases can be traced both to the use of chemically different materials as well as to variations in the amount of wear of moving train parts. For example levels of train brake tracer elements such as Ba or Sb can be over 100 times higher in the subway than outdoors.*
- *There are a number of practical steps that can be taken to improve subway air quality, the first being to create an informed awareness of the problem.*

*An initial air quality audit will assess the current situation on station platforms and inside trains. Underground night work teams need to minimize creating fugitive dusts, tunnels and platforms need to be cleaned regularly to avoid the build-up of particulates, and outdated fan ventilation systems can be replaced by new, more intelligent designs linked to neural networks monitoring air quality above and below ground. Some of the most innovative subway systems worldwide, such as that of Seoul, are already using air purifiers on platforms and in trains. Installing PSD systems has proven to be a very successful way to maintain good air quality in the station.*

## 4. ACHIEVED DISSEMINATION STRATEGY

Dissemination of the project has been successfully wide-ranging and the obtained results, along with the consequent suggested measures to improve the air quality in platforms and trains of subway systems, have been widely publicized.

### Stakeholders

IMPROVE LIFE participants have had meetings with 12 subway national and international authorities and stakeholders. IMPROVE LIFE results were presented to:

- *Transport for London, Vienna Metro (U-Bahn),*
- *Malaga Metro, Metro Bilbao, Metro Valencia, Metro Sevilla, Metro Madrid,*
- *The International Association of Public Transport (UITP),*
- *Renfe (Spanish National Rail Network), Adif (Spanish Construction and Management of Rail Infrastructure),*
- *Ayuntamiento de Barcelona (Barcelona City Council),*
- *TMB health and safety committee.*

### Media

IMPROVE LIFE was featured in:

- *5 TV programmes,*
- *51 web and press releases,*
- *10 interviews in the radio.*

### Dissemination material

- *A user friendly website <http://improve-life.eu/>,*
- *Two informative videos in 3 languages -English, Spanish and Catalan- of 10 (in the web page) and 20 (to be shared with other subway systems) minutes,*
- *A Layman's Report,*
- *One leaflet,*
- *Notice boards,*

- *16 publications in scientific journals,*
- *2 publications in EU magazines,*
- *A technical guide based on the results of the project with recommendations on air pollution mitigation was also prepared and is being delivered to relevant subway stakeholders and policymakers (also available in <http://improve-life.eu/>).*

## **Events**

- *Organisation of one International Conference,*
- *Organisation of two workshops,*
- *Eighteen presentations in international conferences,*
- *Participation in 6 events,*
- *Organisation of one LIFE networking event,*
- *Networking with other LIFE projects.*

## **5. FUTURE DISSEMINATION ACTIVITIES**

The After-Life communication and continuation plan aspires to ensure the sustainability of the project outcome and further promote its objectives.

Its main aspects are:

- *The project website including key strategies and experience gained through IMPROVE LIFE project. The website will be operating until 2023.*
- *The close operational relationship developed between the IMPROVE members (CSIC and TMB) will continue in the future, for example working together through the project's website and on future projects, as demonstrated by the ongoing recently funded BUSAIR project (2017-2020) designed to investigate the air quality inside public buses with different fuels.*
- *Meetings with stakeholders from other international subway systems for the continuous update of mitigation measures and strategies. This will assure the continuous involvement of stakeholders in the policy context of the project.*

- *Activities to raise public awareness and engagement will be taken up as science communication events and festivals – open days at institutions to inform the public of the science which are conducted in their local area for example.*
- *Additional publications of IMPROVE LIFE findings in peer reviewed journals, using open access journals wherever possible.*
- *The IMPROVE LIFE results and recommendations will continue to be presented at conferences, workshops and symposia during the course of the upcoming years.*
- *These results will be available and explained to any third party that requests it (by the website and on request to the project coordinator).*

Sources of funding to cover the costs of these activities include current and future research projects (i.e. ACS and BUSAIR Spanish funded projects) and internal resources from permanent CSIC staff members.

## 6. PROJECT DATA

<b>PROJECT REFERENCE</b>	<b>LIFE13 ENV/ES/000263</b> <b><a href="http://improve-life.eu/">HTTP://IMPROVE-LIFE.EU/</a></b>
<b>DURATION</b>	01-OCT-2014 to 30-MAR-2018
<b>TOTAL BUDGET</b>	813,727.00 €
<b>EU CONTRIBUTION</b>	406,863.00 €

**CLEANER SUBWAY AIR MEANS  
HEALTHIER AND HAPPIER COMMUTERS:  
IT IS WORTH THE EFFORT**



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