LIFE13 ENV/ES/000263

Summary review

October 2016

IMPROVE LIFE13 ENV/ES/000263

Coordinated by

CONTENT

1. ACTIVITIES FOLLOW-UP

The following summary report covers IMPROVE LIFE13 ENV/ES/000263 activities from **01/07/2016 to 30/09/2016.**

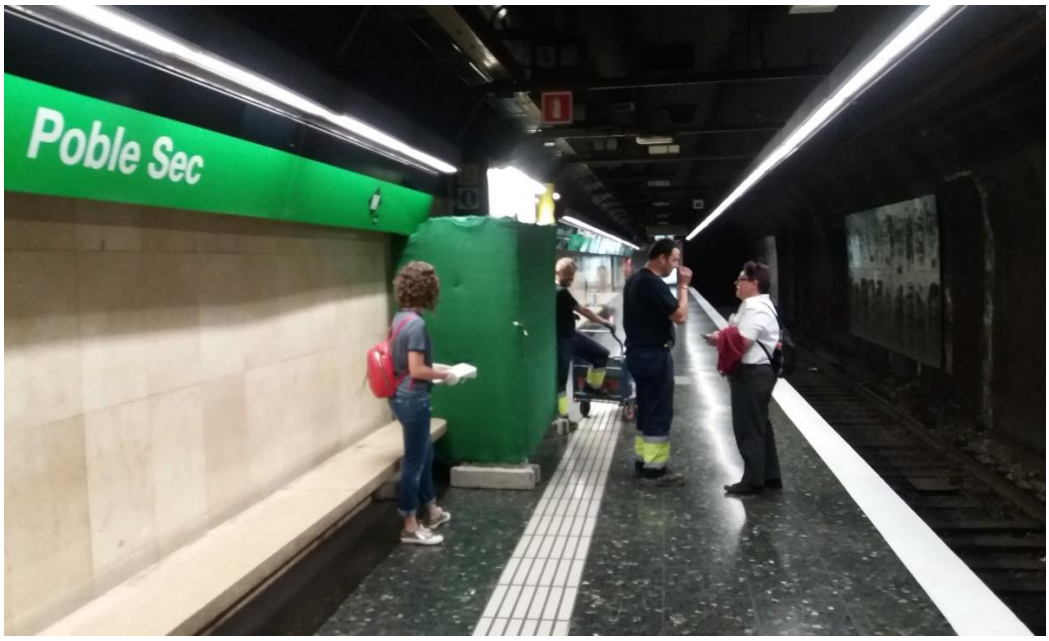
Activities were launched on time and the project progresses according to the proposed timetable. The main tasks initiated or accomplished at each action in progress were as follows:

- ***Actions B1 and B2*** "Determination of the impact of selected parameters and Testing mitigation measures and development of mitigation strategies". Action B1 has been completed on 30th September as had been discussed during the monitor team visit last June. Action B2 is still in progress and is planned to finish on 30th June 2017, therefore the dates for completion of the deliverables for this action have consequently been extended. Measuring campaigns will last until 3rd of November, and chemical analysis of samples and data treatment will be carried out during the following months.

  During the period covered by this report measurements progressed at Collblanc station (L9) from 11th May to 11th July (Action B1). This station belongs to the newest metro line of the city, opened in February 2016. The architecture of the station is characterized by a single tunnel with one rail track separated from the platform by a wall with platform screen doors (PSD), and by an advanced ventilation setup. After assessing differences in air quality parameters related to changes in the standard ventilation settings, instruments were moved to an out-of-service platform of this same station from 27th June to 11th July, aiming to investigate on the factors affecting air pollutants in the absence of in-motion trains and passenger's occupancy. Mean $PM_{2.5}$ and CO_2 concentrations were 15% lower at the out-of-service station. Conversely, CO concentrations were 65% higher. Further research is in progress.

  Previous campaigns have revealed the impact on passenger's exposure to air pollutants attributed to renewal works in tunnels. Thereby, the following campaign within Action B2 is aiming to investigate the effects on air quality linked to the addition of ballast to tunnels, validating the results obtained in summer 2015 under similar conditions. Accordingly, two different methods will be tested and compared, namely: 1) addition of ballast under normal conditions (ballast +water), and 2) addition of ballast using a commercial available anti-resuspension polymer (ballast +water +dust suppressant). The station of Poble Sec (L3) has been selected for this campaign. This station is characterized by one tunnel with two rail tracks separated by a middle wall, thus separating both platforms. Air quality measurements started at 14th September and will end by November. Measurements will be divided in two different periods, according to the method used to add ballast. Each different method will be applied at a different side of the tunnel. Instruments will be moved from one platform to the opposite one, following the schedule of the tunnel works. Both sampling periods will include days under normal conditions and days affected by works (including adding and levelling ballast).

All the campaigns involve the deployment of several equipments at one end of the platform of the selected stations fulfilling all the necessary safety conditions. The monitoring equipment includes a high volume $PM_{2.5}$ sampler (for daily sampling particulate matter below 2.5 microns), passive samplers for NO_2 monitoring, and automatic equipments registering continuously concentration levels of i) PM in 3 sizes (1, 2.5 and 10 microns); ii) particle number concentrations in 16 size ranges; and iii) CO, CO_2, temperature and relative humidity every 5 minutes.



Actions B1-B2. Location of IMPROVE LIFE air monitoring equipment in one of the platforms of the Poble Sec station in Line 3.

Complete chemical analyses of all the $PM_{2.5}$ samples collected by the high volume sampler at all the platforms studied were planned with the objective of determining the variations in chemical composition driven by the influence of the different activities performed and situations tested. The chemical analyses include:

A) Determination of major and trace elements. To this end, a quarter of each filter is acid digested and the resulting solution is subsequently chemically analysed by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES: IRIS Advantage TJASolutions, THERMO) and Mass Spectrometry (ICP-MS: X Series II, THERMO).

B) Determination of major ions (nitrate, sulphate, chloride and ammonium). To this end a quarter of each filter is water leached with de-ionized water to extract the soluble fraction. The solution obtained is analysed by ion chromatography and by selective electrode.

C) Determination of Total Carbon (TC). This analysis is performed by an elemental analyser using a portion of each filter.

D) Determination of molecular organic species in a selection of the samples. A subset of samples is selected to perform these extra analyses. The subset of samples is selected so that it is representative of the entire set. Hence, the average $PM_{2.5}$ concentration of the subset of samples is similar to the average $PM_{2.5}$ concentration of the entire set. Moreover, the different situations (renewal works activities, ventilation settings, etc.) are represented by the subset of samples. Concentrations of molecular organic species are determined after extraction by methanol/dichloromethane (1:1 v/v), derivation of esters to TMS-esters and subsequently detection and quantification in a gas-chromatograph coupled to a mass-spectrometer (GC-MS) in full-scan mode.

Up to September 2016, a total of 163 samples had been completely analysed (71 samples from Sagrera station, 44 samples from Palau Reial station, 27 from Maria Cristina station and 21 from Tarragona station). Moreover, 33 samples from Santa Coloma station, 46 samples from Joanic station, 17 samples from Sant Ildefons station and 39 samples from Tarragona station have been chemically analysed completely except for the ion chromatography analyses**.** Furthermore, 32 additional samples from Tarragona station have been analysed for ICP-AES, ammonium and TC (while the ICP-MS analyses are in progress). Finally, 27 samples from Collblanc station have been analysed for TC. During the specific period for the present report (July to September 2016), 39 samples from Tarragona station were analysed for ammonium concentrations, 32 additional samples from Tarragona station have been analysed for ICP-AES (complementing the 39 samples from Tarragona station from the campaign carried out in March-May 2016 already analysed in the previous period); 114 samples have been analysed for TC, from which 17 from Sant Ildefons station, 71 from Tarragona station and 27 from Collblanc station. The selection for the subset of samples to be analysed for organic molecular species is under progress.

Regarding the indicators of progress of both actions, the construction of a database detailing the concentrations of chemical tracers for pollutant sources in subway systems and the impact of each of them on air quality is in progress as still PM samples are being collected at the moment. Furthermore the final report overviewing and comparing the full impacts on air quality of each of the selected parameters is in progress until all samples are analysed. A draft of the deliverable on the "Report on main air pollutant sources contribution" for Action B1 has been prepared during these three months.

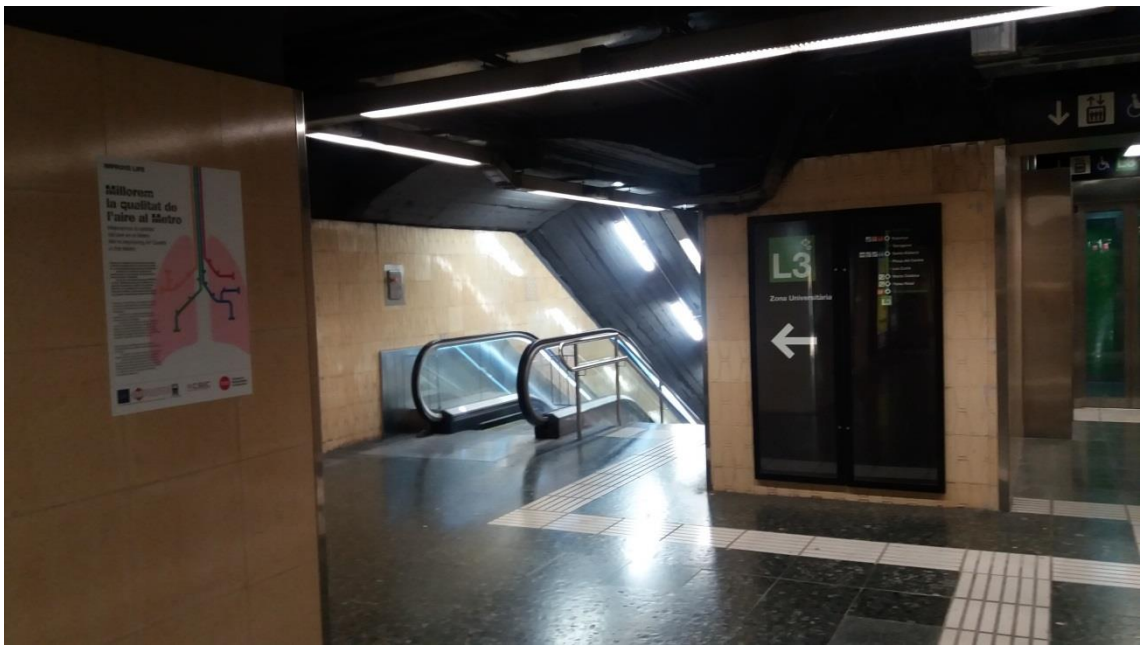
- ***Action C1*** "Effectiveness of the project actions". The impact of the implementation actions of IMPROVE will be evaluated once they have been completed. Actions B1 and B2 are being carried out intensively since January 2015 (B1) and both are very closely related. Action B1 has been completed at the end of September, and Action B2 has been extended until June 2017 as described in the previous 3 months report (this matter was discussed and agreed with the LIFE Monitoring Team from NEEMO EEIG during her visit last June).

  The report from the external committee evaluating the progress of the project is on progress and will be prepared during the first three months of 2017.

- ***Action C2*** "Assessment of the socio-economic impact of the project". This action started on July 2016. An on line questionnaire about different aspects of IMPROVE is being elaborated and will be launched in the project webpage during the next trimester. This follows the last year questionnaire carried out by TMB within subway passengers, aiming to know opinions/knowledge from a different population.

- ***Action D1*** "A Project website designed as a tool to raise the profile of the project and improve the dissemination of its activities". The web site of IMPROVE LIFE (http://improve-life.eu) was launched in December 2014 and is updated in a 2-week basis. Main updates during this period have been on reports, scientific publications and conference presentations of the project, activities and results. A visitor's counter has been added to have a more detailed knowledge of the web views. The page has had an average of 1000 hits per week during September (similar to previous months).

- ***Action D2*** "LIFE+ Information board will be on displayed describing the project at the locations where it is implemented, at strategic places accessible and visible to the public". LIFE+ Information boards are on display since January 2015 describing the project at the locations where it is implemented, at strategic places accessible and visible to the public. By September 2016 hard information boards on the project have been placed at Sagrera, Palau Reial, Maria Cristina, Tarragona, Santa Coloma, Joanic, Saint Ildefons, Collblanc and Poble Sec stations where measurements have been performed. Panels are also permanently displayed in IDAEA-CSIC (Palau Reial) and TMB (Santa Eulalia) main offices. As previously, no vandalism problems have occurred during the July-September period.



Action D2. IMPROVE LIFE panel displayed in the lobby of the Poble Sec station (L3).

- ***Action D3*** "Dissemination of project results". During this period the following activities to disseminate IMPROVE LIFE results have been carried out:

  - ✓ Two informative **videos**, of 10 (to be shown in the web page) and 20 (to be shared with other subway systems) minutes explaining the aims of the IMPROVE LIFE project are in preparation. The script has been translated into three languages (English, Spanish and Catalan). Final result will be available in the next trimester.
  - ✓ **Technical publications** on the project results in scientific conferences acknowledging the LIFE+ financial support during this period:

    Martins, V. et al. Exposure to airborne particles in three European subway systems. Presented at the 4th Iberian Meeting on Aerosol Science and Technology (RICTA 2016). Aveiro, Portugal, July 2016.

    Minguillón, MC. et al. Subway aerosol sources and influence of special activities in subway air quality. Presented at the 4th Iberian Meeting on Aerosol Science and Technology (RICTA 2016). Aveiro, Portugal, July 2016.

    Moreno, T. et al. The effect of ventilation protocols on subway air quality. Presented at the 14th International Conference Of Indoor Air Quality And Climate, in Ghent, July 2016.

    Minguillón, MC. et al. Aerosol sources and influence of special activities in subway environments. Presented at the 22nd European Aerosol Conference (EAC2016). Tours, France, September 2016.

    Moreno, T. et al. Effects of maintenance works and ventilation settings on the PM concentrations in subway platforms. Presented at the 22nd European Aerosol Conference (EAC2016). Tours, France, September 2016.

Action D3. IMPROVE LIFE in the 14th International Conference Of Indoor Air Quality And Climate Ghent, Belgium July 3-8.

- ***Action E1*** "Project Management and Audit". The next report to be delivered is the Midterm report that will be submitted by December 2016.

- ***Action E2*** "Monitoring of the project progress according to indicators defined by the managing team". Three-month summary reviews, as the present one, are being prepared since the beginning of the project and published in the web page. Regular meetings every month of all partners to discuss developments, problems and progress of the project have been hold (more frequently than initially programmed), including:

  - ✓ Elaboration of dissemination video about the project. 11th, 18th July. CSIC: Cristina Reche, Teresa Moreno; TMB: Eladio de Miguel, Jorge Gimenez.
  - ✓ Selection of station for next sampling campaign adding new ballast. 22nd July. CSIC: T. Moreno; TMB: Marta Capdevila, Joan Granes Puig, David Carulla Gonzalez.
  - ✓ Discussion on ventilation settings in Collblanc and Tarragona. 28th September. CSIC: Teresa Moreno; TMB: Eladio de Miguel, Marta Capdevila.

- ***Action E3*** "Networking with other European projects (including LIFE+)". A list of related projects is continuously updated in the project web page. During these three months IMPROVE LIFE has had meeting with:

  - ✓ Prof. Alexis Lau of the Hong Kong University of Science and Technology (HKUST). 20th July 2016. Prof. Lau is coordinator of several projects measuring AQ for different transport modes (including Hong Kong underground and aerial metro systems) and is organising a conference event next year to which IMPROVE LIFE will be invited to present results.
  - ✓ IMPROVE LIFE will collaborate in the organisation of the next Iberian Meeting on Aerosol Science and Technology (RICTA 2017). During 2 days (next July) several presentations by internationally known scientists on subway and public transport air quality will be delivered to researchers, governmental institutions (Spanish and European in general), public transport associations (from other international and national metro systems already contacted during the project), and the general public. Scientists from other European (including LIFE) projects will be invited to share their experiences and contribute propositions for the best implementation of the project.

2. LIST OF THE PROJECT'S OUTCOMES DURING THE PERIOD

ACTION	DATE	TITLE

2.1. IMPROVE LIFE publications

2.2. IMPROVE LIFE reports

E2	30/09/2016	Summary review

2.3. IMPROVE LIFE other dissemination materials

D1	30/09/2016	Project website (updated)

3. DISSEMINATION ACTIVITIES

ACTION	DATE	TITLE

3.1. IMPROVE LIFE events

3.2. IMPROVE LIFE presentations in other events

D3	07/2016	Martins, V. et al. Exposure to airborne particles in three European subway systems. Presented at the 4th Iberian Meeting on Aerosol Science and Technology (RICTA 2016). Aveiro, Portugal, July 2016. Minguillón, MC. et al. Subway aerosol sources and influence of special activities in subway air quality. Presented at the 4th Iberian Meeting on Aerosol Science and Technology (RICTA 2016). Aveiro, Portugal, July 2016. Moreno, T. et al. The effect of ventilation protocols on subway air quality. Presented at the 14th International Conference Of Indoor Air Quality And Climate, in Ghent, July 2016.
D3	09/2016	Minguillón, MC. et al. Aerosol sources and influence of special activities in subway environments. Presented at the 22nd European Aerosol Conference (EAC2016). Tours, France, September 2016. Moreno, T. et al. Effects of maintenance works and ventilation settings on the PM concentrations in subway platforms. Presented at the 22nd European Aerosol Conference (EAC2016). Tours, France, September 2016.

3.3. IMPROVE LIFE networking with other projects

D3	07/2016	Prof. Alexis Lau of the Hong Kong University of Science and Technology (HKUST). Prof. Lau is coordinator of several projects measuring AQ for different transport modes (including Hong Kong underground and aerial metro systems) and is organising a conference event next year to which IMPROVE LIFE will be invited to present results.

4. DELIVERABLES AND MILESTONES CHECK-UP (30/06/2016)

(Shown in green those already completed, and in yellow those in progress)

START	ACTIVITIES FOLLOW-UP	OUTCOMES available on-line at:	DEADLINE
A. PREPARATORY ACTIONS			
A1 Documentation of current status and selection of critical parameters to be tested			**31-march-15**
1-oct-14	Construction of 1 historical database of studies examining the methods used to identify and resolve the contribution of aerosol emission sources and their major results	**Deliverable 2 Historical source contribution**	31-jan-15
	Elaboration of 1 list of the main parameters identified to be considered in all studies	**Deliverable 4 Parameters to test**	31-march-15
	Prioritisation of air pollution sources in subway systems	Milestone D Main Air Pollution sources	31-jan-15
B. IMPLEMENTATION ACTIONS			
B1 Determination of the impact of selected parameters			**30-jun-16**
1-jan-15	Organisation and coordination of a campaign program	Campaigns calendar	15-dic-14
	Presentation of Technical reports on the advance of:	Report 1 Campaigns	30-apr-15
	- sampling campaigns		
	works		
	air conditioning in trains (series 2 & 3K)		
	ventilation	Report 2 Campaigns	31-oct-15
	air conditioning (series 5K)		
	rail change		
	brake pads		
	ventilation		
	graphite pantograph		
	- chemical analysis inorganic PAH in PM filters NO2 samples	Report 3 Campaigns	31-mar-16
	- results of the chemical analyses		
	- statistical analysis,		
	- results of source apportionment		
	Determination of the impact of main air pollution sources	Milestone G Impact of main air pollution source	31-dic-15
	Identification of the main pollutant tracers	Milestone H Main pollution tracers	31-dic-15
	Construction of 1 database with concentrations of chemical tracers for pollutant sources in subway systems and the impact of each of them on air quality	Database 2 Chemical tracers concentration	31-mar-16
	Characterisation of the emission sources	Milestone K Characterisation emission sources	30-jun-16
	Report on the overviewing and comparing the full impacts on air quality of each of the selected parameters	**Deliverable 8 Report sources contribution**	30-sep-16

START	ACTIVITIES FOLLOW-UP	OUTCOMES available on-line at:	DEADLINE
B2. Testing mitigation measures and Development of mitigation strategies			**30-sep-16**
1-abr-15	Organisation and coordination of a campaign program	Campaigns calendar	1-dic-14
	Presentation of Technical reports on the advance of:	Report 1 Campaigns	30-apr-15
	- testing mitigation measures and estimated benefit in metro ambient air quality		
	ballast with water		
	air conditioning in trains (series 2 & 3K)	Report 2 Campaigns	31-oct-15
	ballast with dust suppressant		
	ventilation		
	air conditioning (series 5K)		
	brake pads	Report 3 Campaigns	31-mar-16
	ventilation		
	graphite pantograph		
	Proposal of measures for air pollution emission reduction	Milestone I Propose mitigation measures	31-may-16
	Testing of mitigation measures for emission sources	Milestone J Test mitigation measures	31-may-16
	Evaluation of mitigation measures	Milestone L Evaluate mitigation measures	30-sep-16
	Report on the results of mitigation measures in subway systems	**Deliverable 9 Report Mitigation measures**	30-mar-17
	Preparation of 1Technical Guidance documentation, identifying and comparing effective strategies for reducing the impact of each selected emission source.	**Deliverable 10 Technical guide mitigation measures**	30-june-17
C. MONITORING ACTIONS			
C1 Effectiveness of the project actions.			**31-mar-18**
1-abr-15	Definition of (Management Team) a list of parameters/ indicators to assess the impact of the project including: - initial situation regarding PM levels and sources (Action A1) - identification of air pollution sources during the campaigns (Action B1) - contribution of each of the emission sources identified	List 2 Impact indicators	31-dic-16
	Nomination of an external committee to evaluate the progress of the project after 2 years	Commitment of members	30-jun-15
	Elaboration of 1 Quality plan for the political effectiveness of the project	**Deliverable 12 Report policy effectiveness**	31-dic-17
	Monitor of the impact of the project	Milestone P Monitor the impact of the project	31-mar-18

START	ACTIVITIES FOLLOW-UP	OUTCOMES available on-line at:	DEADLINE
C2 Assessment of the socio-economic impact of the project.			**31-mar-18**
1-jul-16	Monitor of the awareness of the problem (annually *not every 6 months*) with a questionnaire to public:	**Deliverable 11 Questionnaires for public**	31-dic-17
	- Number of people participating.		
	Incentive other metro systems, or local authorities to apply measures proposed by IMPROVE	List 3 Replicated measures	31-mar-18
	Assessment of the socio-economic effect	Milestone M Assess Socio-economic effect	31-dic-17
	Report on the socio-economic impact of the project	**Deliverable 18 Report Socio-economic Impact**	31-mar-18
D. COMUNICATION AND DISSEMINATION ACTIONS			
D1 A Project website.			**31-mar-18**
1-oct-14	Design and maintenance of the project website	**Deliverable 1 Project website**	31-dic-14
	Monitor of the number of visitors.	6 Summary reviews	31-mar-18
D2 LIFE+ Information boards.			**31-mar-18**
1-oct-14	Preparation and placing of 10-15 information boards	**Deliverable 3 Information boards**	31-jan-15
	Maintenance of boards in the metro facilities	13 Summary reviews	31-mar-18
D3 Dissemination of project results			**31-mar-18**
1-oct-14	Design and elaboration of 300 leaflets.	**Deliverable 7 Informative leaflets**	30-jun-16
	Publication of articles (4-6) in local/national press (quantification of their readership), during actions B1 & B2 and at beginning/end of project	**Deliverable 15 Articles in general/trade press**	31-mar-18
	Submission of 6 technical papers/presentations in international journals/conferences	**Deliverable 13 Publications journals/conferences**	31-mar-18
	Organisation of 1 open-forum Stakeholders (around 80 people) private and public sector	Milestone E Organize open-forum	30-jun-15
	Publication of the forum's outcomes on the project's web site.	**Deliverable 5 Minutes of the open Forum**	30-sep-15
	Organisation of 1 international conference (200 people) with researchers, governmental institutions, public transport assoc. and public.	**Deliverable 17 Proceedings of the conference**	31-mar-18
D4 Production of Layman's Report.			**31-mar-18**
1-jul-16	Production and dissemination of 2.000 copies to the stakeholders	**Deliverable 16 Layman's Report**	31-mar-18

START	ACTIVITIES FOLLOW-UP	OUTCOMES available on-line at:	DEADLINE
E. MANAGEMENT ACTIONS			
E1 Project Management and Audit.			**31-mar-18**
1-oct-14	Nomination of the Project Management Team	Milestone A Project management team	31-oct-14
	Elaboration of the Quality assurance plan	Milestone C Quality assurance plan	30-nov-14
	Submission of the Inception Report	Inception Report	30-jun-15
	Submission of the Mid-term Report	Mid-term Report	31-dic-16
	Submission of the Final Report	Final Report	30-jun-18
E2 Monitoring of the project progress.			**31-mar-18**
1-oct-14	Revision the progress of the project, according to its indicators.	Milestone B Indicators of Progress	30-nov-14
	Meeting between partners	**Deliverable 19 Summary reviews**	31-mar-18
	Implementation of corrective recommendations after each meeting if necessary		
E3 Networking with other European projects (including LIFE+).			**31-mar-18**
1-oct-14	Organisation of 1 expert group workshop	**Deliverable 6 Minutes of the expert's workshop**	30-sep-15
	Organisation of 1 workshop with other European projects	Milestone F Workshop with LIFE+ projects	30-jun-17
	Participation in other LIFE+ project's meetings	Presentations of IMPROVE	31-mar-18
E4 After-LIFE+ Communication Plan.			**31-mar-18**
1-jul-16	Preparation of the After-Life communication plan	**Deliverable 14 After-Life communication plan**	31-mar-18