MITIGATION AND ADAPTATION ACTION PLAN, PILOT ACTIONS AND MONITORING PLAN TO VERIFY EFFECTIVENESS OF ACTIONS IN THE FUA OF PARMA

Joint deliverable D.T2.1.2 - D.T2.1.3 - D.T2.2.1	04 2020

Aims:

Action plans will organize information for planning and implementing pilot tests foreseen in D.T2.2.2 and D.T2.2.3. Pilot tests will be implemented in 4 target FUAs, described in D.T2.1.1, during 2018/2019 and 2019/2020 winter seasons. Action plans will contain all information related to:

- **Deliverable D.T2.1.2**: Suitable mitigation & adaptation action plans at the target FUAs: Preparation of ad hoc action plans containing the details of the potential best mitigation & adaptation methods to be developed in each individual FUA. They will be developed according to methodological approach agreed in D.T1.3.1-2 and applied in AT2.2

- **Deliverable D.T2.1.3**: Specific monitoring plan of the effectiveness of actions at the target FUA: Preparation of tailored monitoring plans (1 x FUA) containing the details of criteria & methodologies to assess the effectiveness of the all the mitigation & adaptation actions contained in action plans D.T2.1.2 and can be exploited in pilot actions (AT.2.2)

- **Deliverable D.T2.2.1**: Preparing pilot tests in specific FUAs, according to specific characterization: The FUA will plan in a coordinate way all interventions in terms of time schedule and assignments (if needed) in order to better manage each pilot. This is intended also as decision taken tables of coordination among different stakeholders

Pilot tests are intended as:

- **Deliverable D.T2.2.2** Pilots tests (administrative) implemented in specific FUA according to specific features & needs: the concerned FUAs will agreed on specific administrative policy instruments (e.g.: incentives / procedures, measures linked to compliance or not towards cities regulations (i.e.: related to traffic reduction or lowering heating) addressed to target stakeholders).

- **Deliverable D.T2.2.3** Pilots tests (technological) implemented in specific FUA according to specific features & needs: Pilot tests consisting in utilization & application of solutions deriving from Key Enabling Technologies – KETs (such as devices to reduce exposure, electronic sensors) applied at FUA level.

Action Plans will be constantly updated until the end of pilot tests implementation. Indeed, pilot tests also rely on political decision which cannot completely plan in the long run.

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Contents

1. INTRODUCTION

Aim of this document is to describe how general approach and methodologies the partners agreed upon in WPT1 with reference to suitable actions to be put in place in order to reduce exposure to air pollutants and related health effects have been translated and adapted to the Parma FUA.

The first phase of definition of the set of actions to be adopted was devoted to an analysis of the pecularities of the Parma FUA and of the most relevant drivers and sources of air pollution at local level. The deliverable D.T2.1.1 ("Key elements from each FUAs") supported the conclusions from local AWAIR partners that main drivers of air pollution were mobility, energy and agricolture and main sources traffic, domestic heating, industry and livestocks. The local assessment of driver and sources was therefore similar to what reported in the general assessment (D.T1.2.1).

The action plan was then developed according to the methodological approach defined in D.T1.3.1-2 and the criteria and methodologies to assess effectiveness defined in D.T2.1.3.

The document ecompasses the goals of the deliverables D.T2.1.2, D.T2.1.3 e D.T2.2.1 based on the idea that this choice would have made the description of the various actions more consistent and clear. In particular, objectives and general planning was described for every action (D.T2.1.2), together with indicators to be used for monitoring and assessment of effectiveness (D.T2.1.3) as well as time schedule, spatial level of implementation and stakeholders to be involved (D.T2.2.1). Specific sections were devoted to pilot tests. In this case the indicators for assessment of effectiveness will be calculated quantitatively during the project's life and reported in D.T2.2.2-3 while for other actions such indicators are to be considered as qualitative evaluation or criteria for future assessment.

The text is organized in two main sections, one for mitigation actions and one for adaptation actions. Within each section, specific sub-sections are defined for the actions most strictly related to severe air pollution episodes (*short term actions*) and for the long term actions which can affect air pollution episodes but only in an indirect way. Drivers, air pollutant emission and concentration, exposure and health effects were considered in the choice of the set of actions. A specific focus within adaptation actions, was devoted to vulnerable people and in particular to the elderly, people affected by pathologies and children.

2. MITIGATION ACTIONS

A number of mitigation actions have been put in place in the Parma FUA during the last decade. In this section we present actions specifically implemented during the AWAIR project or actions already activated from the administration during the last years and with which an operational link has been established with mutual benefit.

A key role in the definition of the AWAIR actions was played by the Integrated Air Plan of the Emilia-Romagna Region (PAIR). This plan was approved during evaluation phase of the AWAIR project and could be considered a first important administrative test for the AWAIR project. The plan is coordinated by the Emilia-Romagna Region and agreed among the main Municipalities of the Emilia-Romagna region with the aim to reduce air pollutant levels. Another strong link was established with the PREPAIR project. PRAPAIR is a giant Life project involving all Italian regions of the Po plain (plus Slovenian Republic) aimed to improve air quality of the study area. The project was funded with 66 millions euros and will end in 2022.

Based on the fact that AWAIR activities are focused on air pollution episodes the pilot tests were strongly related to short term measures (such as those related to traffic restrictions) and/or high spatial/temporal air pollution monitoring at FUA scale.

2.1 Short term actions to be adopted in case of SAPE

2.1.1 Mitigation measures in case of SAPE

One of the main pillar of the PAIR2020 plan concerns the actions to be taken during severe air pollution episodes. From 1 October to 31 March diesel cars having emissions class equal or below EURO 3 and petrol cars with emission classes equal to EURO 1 or below are not allowed to circulate from 8.30 a.m. to 6.30 p.m. In addition, a bulletin is delivered by the Regional Agency for Prevention, Environment and Health (Arpae) to define the coming days as alert or no-alert days. In particular, the bullettins are delivered on Monday and Thursday with the next days considered alert days if PM10 concentrations during the three previous days were above the EU daily PM10 limit value (50 mg/m3) and if PM10 forecasts show persitence of bad air quality. In case both conditions are met, a set of measures are activated. These measures include:

- Traffic ban for Euro 4 diesel cars;
- Indoor temperatures in homes and offices to be kept below 19° C and below 17° C in industrial work places;
- Ban for the use of biomass for domestic heating (provided that alternative way for domestic heating are available).
- Prohibition of fires (bonfire, barbecue, fireworks);
- Prohibition to stop any vehicle with the engine on;
- Ban for spreading of zootechnical slurry (excluding landfill with direct injection to the ground);

In addition, the plan pushes local administrations to increase controls to verify whether the measures are respected or not. The table below shows the time schedule till 2021 of traffic restrictions to be applied for the whole winter seasons.

Municipality of Parma: ordinary measures TRAFFIC LIMITATION from October 1st to March 31st	
2018 - 2019	Ban Petrol vehicles up to EURO 1, Diesel vehicles up to EURO 3 Motorcycles and mopeds EURO 0
2019 - 2020	Ban Petrol vehicles up to EURO 1, Diesel vehicles up to EURO 3 Motorcycles and mopeds EURO 0
2020-2021	Ban on petrol vehicles up to EURO 2 Diesel vehicles up to EURO 4 Motorcycles and mopeds EURO 1

Increasing attention is being devoted to biomass burning with and impressive amount of data coming from the PREPAIR project in terms of emissions from different types of biomasses (wood, pellets etc) and way of burning (stoves, fires etc).

Indicators of effectiveness: Reduction of traffic flows and air pollutant emissions.

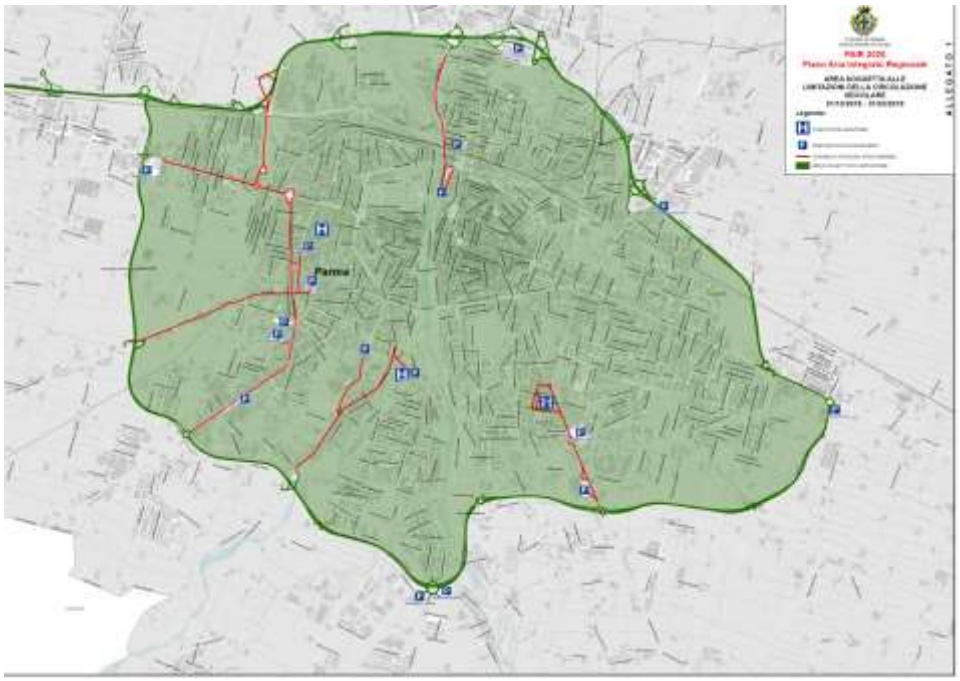
Spatial level of implementation: Parma FUA

Stakeholders to be involved: Citizens, Agricolture activities, Mobility managers.

2.1.2 Pilot test 1 – Traffic restrictions and impact on Black Carbon, PM size distribution and other traffic-related pollutants

The first pilot action indentified by Italian AWAIR partners was strictly connected to the assessment of effectiveness of emergency measures selected in the PAIR2020 plan and in particular to the measures related to the traffic restrictions already listed in the previous paragraph. The time planning of these restrictions includes the ban for circulation of diesel car EURO 5 from October 2020. In addition, other initiatives to reduce air pollutant concentration and increase people awarness some "ecological Sunday" have been planned throughout the year.

While a significant part of the Parma municipal territory is interested by traffic restrictions there are some peripheral and rural areas not affected by these measures. The specific area, inside the ring road, where traffic restrictions are applied is shown in the next figure.



Criteria and methodologies to assess effectiveness

Impact of traffic restrictions will be assessed with measurement campaigns of Black Carbon, NO2, Benzene, CO, PM10 and PM size distribution. These indicators are strictly related to direct traffic emissions (in particular from diesel cars). Two of them in particular (Black Carbon and Particle Size Distribution) are not yet included in the UE list of pollutants to be monitored but their importance in relation to health has been emphasized by WHO.

A monitoring site was located at a traffic site within the urban area of Parma. A mobile station equipped with PM size distribution and Black Carbon monitors (MAAP) in use by Arpae has been placed next to the fixed monitoring station (urban traffic station).

Another monitoring site was located at a suburban site not affected by traffic restrictions. The figure below shows the location of the two mesurement sites.

Reduction pf air pollutant concentration during alert days with traffic restriction will be primarily used to assess effectiveness of this pilot action.

Further assessment of effectiveness will be carried out in terms of reduction of traffic flows. A sonar traffic counter was installed at roadside to monitor fluxes of bikes, cars and heavy tracks (see figure below).

Roles assigned for the implementation of the pilot test

- *ARPAE*: air pollutants monitoring at the "Montebello" traffic station in Parma and in the suburban area in Colorno (see section "Criteria & methodologies").
- *Municipal police*: checks for compliance with the traffic restriction measures
- *Municipality*: Administrative deeds and dissemination of information
- *Region*: Requirements on traffic limitations

Roles of stakeholders in pilot test implementation

- *FUA Municipalities*: During the first informative table on August, 30th, with the participation of CINSA and ARPA, objectives, role of the urban functional area, status of air quality in the area under examination in relation to the reference pollutants, were illustrated. Actions and measures currently in force were also explained with the aim of extending them to the area of FUA. In the second operational table of November, 6th, two - three informative meetings were decided, to be held probably in January 2019 in the 2-3 macro-areas of the FUA identified to sensitize and involve the population and all stakeholders in the territory. All the Municipalities of the FUA were asked to report particularly interested

stakeholders and social partners of their territory to invite to the meetings together with citizenship. Information was provided on:

-the current sustainable mobility and transport services, useful for promoting sustainable travel;

-the new generation tools included in the project in order to verify the effectiveness of the measures;

-the measures that will be adopted;

-the role of the communication to be developed together with the Municipalities interested in the Awair project.

By spring 2019 convening the 3rd coordination table: interventions for the extension of the public and sustainable transport offer to the FUA, as well as the measures of the PAIR2020.

- *Trade associations, environmentalists, health companies, vulnerable groups associations*: Beginning 2019 working tables organization.
- *Citizens*: modifies behaviors related to sustainable mobility through information on the project

Time schedule of activities

- June 2018. Public tender for Black Carbon monitoring activities
- September 2018. Check of instrumentation of the mobile station
- November 2018. Request of permission for occupation of public area to locate the mobile station
- December 2018 – April 2019. 1st monitoring campaign
- November 2019 – April 2020. 2nd monitoring campaign

2.1.3 Pilot test 2 – Performance assessment of air quality sensors at FUA level

Air quality assessment is regulated by national/international legislation. In Europe the framework and legal requirements for assessment and management of ambient air quality is defined in the Air Quality Directive 2008/50/EC. The Directive defines the criteria for air quality monitoring and the reference measurement methods that Member States shall apply when monitoring air quality. A primary role is assigned to fixed monitoring station networks that are subject to strict routines

of maintenance and calibration of their instruments, to ensure high quality data and comparability between different stations and regions.

However, the high costs of installation and maintenance of reference monitoring stations results in a relatively sparse monitoring, which provides accurate data but only in few locations thus not providing information about localized gradients of potential importance to health protection and not meeting the increasing demand for detailed air quality information from citizens.

In order to face this problem and increase the spatio-temporal distribution of air pollution, supplementary techniques have been proposed and also mentioned and recognized by regulatory bodies. In particular, during the last decade regulatory bodies such as EU Commision and US EPA have recognized the importance of new monitoring technologies based on different type of sensors.

The underlying idea is that a cost-effective approach for air quality monitoring would be the implementation of mixed networks involving both reference-grade monitors as well as emerging sensor/monitor technologies. The possible use of sensors-based monitors includes near-source monitoring, community monitoring, emergency response, hot-spot identification, supplemental monitoring to improve the spatial-temporal resolution of current monitoring networks, mobile monitoring, and last but not least exposure assessment for epidemiological studies. The main advantages are related to the fact that they are small and portable, apparently easy to use and deploy, and often low cost or at least much less expensive than reference instruments.

However, despite the high expectations and potential pros, research and regulatory bodies have raised several issues related to the accuracy of such monitors including problems of stability, cross-sensitivity, repeatability and reproducibility.

During the AWAIR activities, we investigated whether sensor based monitoring platforms can provide reliable indications about air quality trends and patterns at urban and suburban scale considering their relocation after field calibration. In particular, in a realistic use of these devices, we focused on comparing performance of different field calibration approaches and algorithms testing the NO2 and O3 sensors at sites distinctly affected by traffic and background pollution levels. Main goals were related to a comparison of sensor performance after relocation using: (i) season specific calibration; (ii) single-site vs site-specific calibration; (iii) simple univariate linear vs more sophisticated machine learning calibration approaches.

Once verified precision and accuracy of these sensors they could be used to build air pollution maps at high spatial and temporal resolution.

Criteria and methodologies to assess effectiveness

The performances of three identical commercially available sensor systems were assessed considering their field calibration in sites with different characteristic and subsequent relocation at distance up to 80 km. The performances were evaluated comparing the data from the sensor systems with measurements from fixed site reference stations (see figure below).

The measurement campaigns were performed in the province of Parma and included measurements next to one urban background station, one urban traffic station, one suburban background station (located in Colorno, 13 kn from the Parma's city center, and one rural station (next to Langhirano, about 20 km from the city center)

Indicator of effectiveness Root Mean Square Error (RMSE) and BIAS calculated comparing hourly mean values of sensor and fixed site station data

Spatial level of implementation: Parma FUA

Roles assigned for the implementation of the pilot test

- *ARPAE*: Monitoring campaigns and data analysis
- *Municipality of Parma*: set permissions to locate mobile station

Stakeholders to be involved

- *FUA Municipalities*: During the informative days with the municipalities of the PARMA FUA the future role of sensors to monitor air pollution in the FUA territory has been explained.
- *Associations*. Collaborations have been established with association interested in carry out air pollution measurements with low cost sensors.

Time schedule of activities

- July 2018. Public tender for acquire four air quality sensor systems
- December 2018 – September 2019. Monitoring campaigns in different sites within the Parma FUA

2.2 Long and medium term actions

Several long and medium term actions have been put in place within the Parma FUA in order to improve air quality and inderectly reduce air pollution severe episodes. The following actions have been implemented by Parma Municipality. The actions are mainly focused on energy and mobility with AWAIR activities aiming at establishing a collaboration among FUA Municipalities to implement these actions in a shared and collaborative way .

2.2.1 Energy

In 2014 the Parma municipality signed up the Covenant of Majors, doing the monitoring in the 2017. The starting point was the PAES baseline, the inventory of the energy uses emissions.

Now, the Municipality is preparing the second monitoring (updated with 2017 data and 2020 goals) and is carrying out the adhesion at Covenant of Majors for the ENERGY AND THE CLIMATE (approved by the City Council on the 21/02/2018) with goals by 2030. Next the municipality will continue with PAESC drafting (Climate Energy Susteinable Environment Plan) that contains in addition to mitigation objectives also those of climate change adaptations.

a) Upgrading school buildings to reduce heat consumption

In 2012 Parma Muncipality has realized a feasibility study on 20 school buildings to verify the possible reduction of energy consumption. The project has started from a detailed Energy-Check on the existing housing features for 4 principal buidings. By now, the energy efficiency interventions were made on 10 school municipal buildings. Furthermore, gyms old lighting were replaced with LED systems and public lighting has been contracted with Energy Performance Contract (EPC) in order to reduce consumption of about 64% (replacing 24.000 lighting with LED systems).

Indicator of effectiveness: Number of informative days to disseminate this good practice to the municipalities of the Parma's FUA
Spatial level of implementation: FUA
Stakeholders to be involved: Energy Service Company (ESCo), Asset management municipal department

b) „Sustainable apartment buldings" strategy interventions on the plants (boiler substitution..) and on the structure (thermal coat, fixtures substitution…)

The project „Energy Parma" („My house in A class") has led to identify an agreement with Crédit-Agricole for € 20.000.000 of loans for energy efficiency at discounted rates, waiting for the answer to participation on Horizon 2020 Call to finance the facilitation process along with Energy Agency (ATES).

Indicator of effectiveness: Number of A-class buildings

Spatial level of implementation: It could be applied in all the FUA through the public loans, partecipation to public call

Stakeholders to be involved: Energy Agency (ATES), apartment buildings administrators, citizens

c) Regulation of wood biomass plants for domestic heating

Ban to install biomass plant <= 3 stars for domestic heating and to install/to use summer/winter air-conditioning plants in cellars, garages, stairwells and common spaces of apartment buildings. The wood biomass plants are certified, as provided by DM 186/2017-Annex 1 and in conformity with EU Directives, on the base of emissive performance classes ("stars"), taking into consideration both energy efficiency and emissions (particulate, COT, NOx, CO).

Indicator of effectiveness: Number of installed >3 stars biomass stoves

Spatial level of implementation: Region

Stakeholders to be involved: Citizens, apartment buildings administrators, Builders

2.2.2 Mobility

The Parma Municipality through the SUMP 2015-2025 (Sustainable Urban Mobility Plan) aims to define, implement and monitor the measures for all transportation modes.

In the long-term strategy of the SUMP the interaction among different urban plans plays a key-role (e.g. Structural Municipality Plan), since the car use is strictly related to the urban structure. The main object is to reduce car use in favor of sustainable transport (bycicle, foot..)

a) Mobility management

The mobility manager of a company analyses the mobility habits of the employees to found actions to reach the objectives stated in the home-to-work mobility plan. Area Mobility manager of the Parma Municipality coordinates the Mobility managers of private and public companies, collecting their needs and founding a strategy to manage overall home to work mobility. Many companies in the Parma territory have edited or are updating their home-to-work mobility plan.

They meet regularly twice a year for follow-ups and trainings. One of this meeting takes place during the mobility week.

Indicator of effectiveness: Number of mobility managers involved in trainings and common projects
Spatial level of implementation: FUA
Stakeholders to be involved: Private and public companies, trade and business associations

b) Intermodality

The object is to create interchange platforms in key points as train station, park-ride . The Parma Municipality has realized in these points some bike-sharing/car-sharing stations. In Emilia-Romagna Region there is a single card for bus and train and it's possible to upload bike/car sharing membership. Furthermore, who has a train membership can use public transportation for free. In the informative meeting in the FUA territory the mobility management activity of the city of Parma and the role of the mobility manager wil be explained.

Indicator of effectiveness: Number of people using intermodality platforms
Spatial level of implementation: FUA
Stakeholders to be involved: Public transport company, Mobility agency, Municipality, Region, citizens

c) Reducing energy uses, in particular fossil fuel

The Municipality of Parma as well as the other municipalities of the FUA have no authority to affect use of fossil fuels. However the municipalities can renew their vehicles choosing low emission vehicles (electric, methane, hybrid). Parma Municipality promotes low emissions car-sharing managed by the mobility agency Infomobility.

Indicator of effectiveness: Number of people using car sharing vehicles
Spatial level of implementation: FUA
Stakeholders to be involved: Public transport company, Local authority

d) Measures to protect city center and residential areas from traffic pollution extending LTZ, pedestrian zones, and 30Km/h zones

Lower speed allows better coexistence among bicycles, cars and pedestrian. To reduce speed the Municipality is considering different approaches depending on the area: bumps, rumble strips, optical decelerators, roundabouts, road marking, safe storage for bikes.

Indicator of effectiveness: Number of low speed zones
Spatial level of implementation: Parma Municipality
Stakeholders to be involved: Citizens

e) Promotion of cycle mobility and extension of cycle lanes

A development of the bikeways network in terms of length, safety and thefts reductionas well as bike services. In Parma there is "Cicletteria" that provides several services such as: repairs, safe storage, bike rental. There are 125,5 Km of bikeways in Parma and the SUMP'goal is increasing them up to 170,5 Km.

Indicator of effectiveness: Number of km of bikeways. Number of people using "cicletteria" services". Reduction of bike thefts.
Spatial level of implementation: Parma Municipality with involvment of some municipalities of the FUA
Stakeholders to be involved: Mobility Agency, Mobility municipal department

f) The development of electric mobility with new recharge points

The SUMP has planned the extension of the network charge, incentives to buy low emission transportation, the renewal of the fleets for the local authorities, and recharging infrastructure for residential buildings.

Indicator of effectiveness: Number of electric vehicles

Spatial level of implementation: Parma Municipality, but the action could be extended to some town of the FUA

Stakeholders to be involved: Mobility Agency, elettric operators, large companies

2.2.3 Logistics

The Municipality of Parma has been engaged for several years in the rationalization of the logistics system. The "Ecologistics" Project aimed at favoring access to the city center for low emission vehicles. The European project Fright Tails (2015 - 2018) developed a strategy to reduce the access in the LTZ of the commercial vehicles who don't meet emission standards and developed new logistic systems to promote aggregation of business operators and goods distributors. A local group has been set up with trade associations, logistic platforms, Municipality and cargo biker to involve all the stakeholders. Then, with stakeholders participation, an action integrated plan (AIP) has been defined to identify 12 actions for a better urban logistic. Later, on 5th February 2019, a cooperation agreement was signed by all the stakeholders to implement the AIP's actions.

a) Rationalization permits for goods delivery

The goal is to implement an accreditation process that considers standard emissions of the vehicles introducing diversified pricing (i.e.: eletric vehicles for free and increased rates based on environmental standards of vehicles)

Indicator of effectiveness: Number of low emission vehicles used for goods delivery

Spatial level of implementation: Parma Municipality

Stakeholders to be involved: Public transport company, Local authority, mobility Agency, retailers and trade associations

b) Incentivise cycle logistic for the last mile

The action aims at promoting goods delivery using cargo-bikes standard and ebikes. The implementation of this action requires a collaboration agreement between Parma Municipality,

retailers, cargo-bike carriers, cargo-bike purchasing incentives and the identification of specific facilities owned by the municipality to be used as micro-center for storing goods.

Indicator of effectiveness: Number of retailers using cicle logistics
Spatial level of implementation: Parma Municipality
Stakeholders to be involved: Retailers, cargo bikers, citizens

c) Incentivise logistic for the last mile

This action aims at the involvement of the biggest local retailers for the centralization, optimization and rationalization of daily deliveries to local shops, hotels , restaurants, bars inside the LTZ in order to merge / aggregate all the deliveries to the city center. The municipality is the key facilitator and it has a coordination role

Indicator of effectiveness: Number of involved local retailers
Spatial level of implementation: Parma Municipality, but the action could be extended to some town of the FUA
Stakeholders to be involved: Big retail chains

d) Check of number and type of permits to access in LTZ for commercial vehicles

The objective is the revise the regulation of passes that allow access and short stop in LTZ for for commercial vehicles.

Indicator of effectiveness: Assessment of number and type of permits to access in LTZ for commercial vehicles
Spatial level of implementation: Parma Municipality
Stakeholders to be involved: Retailers,transporters, freight recipients

3. ADAPTATION ACTIONS

The Parma FUA decided to focus on few adaptation actions. A specific attention will be decoted to increasing awareness of population in relation to major sources of exposure. This will be obtained in a direct way organizing meetings with population and taking part to events and exhibitions or in an indirect way involving different stakeholders.

More specifically, a first type of awareness will related to provide population with information on how to avoid hot spot of air pollution within the FUA (e.g. choosing the right path and way of transport to go to school/work).

A second important topic in terms of awareness will be related to indoor environments. Gas cooking, domestic heating, cleaning activities, smoking and other indoor activities can worsen indoor air quality and increase personal exposure. Numerous studies have shown that the above mentioned sources are able to produce indoor concentrations even higher than outdoors. Improvements in awareness can be obtained also by showing, in a simplified way, the level of pollutants in indoor environments. This may make evident the increase in air pollution in relation to some activities.

These goals will be mainly pursued in the framework of the AWAIR communication activities, of the local multilevel table of co-design and of the activities A.T3.1, A.T3.2 and A.T3.3 (trainings, exercises, events, questionnaires).

However, adaptation actions will include also more specific objectives. A first action will be focused on reducing children exposure in schools. This will be also a test to verify whether it is possible to reduce population exposure with specific actions such as defining protocols for natural ventilation during SAPEs and using air purifiers. Some pilot applications will be performed in schools and possibly applied in the future in other specific settings such as retirement houses, where people need increased protection from air pollution, especially during SAPE.

As a matter of fact, how to protect the health of vulnerable and frailty people during SAPEs will be another main pillar of adaptation actions in the Parma FUA. The efforts within the AWAIR project will be mainly devoted to promote a discussion among experts about the possibility of defining advices or even protocols to be adopted by some target people in case of SAPEs. The discussion will include a large number of experts also from other countries. The definitions of advices will cover different aspects such as use of drugs and diet during SAPEs. A second phase

may include an application of these advices/protocols for some target groups. This phase will require the involvement of stakeholders related to these target groups such associations of asthmatics, diabetics, cardiopathics etc. After this phase, an assessment of effectiveness could be carried out in terms of people involved in this action. Assessment of effectiveness in terms of avoiding health outcomes would be very difficult and it is beyond the scope of the present project. Assessment in terms of variations of biological parameters or health outcomes would require large study population, long observation period and sophisticated study design and/or laboratory analysis. However, it would be important to suggest possible and/or future approach that could be used to assess effectiveness of this type of actions in a more rigorous, direct and effective way.

3.1 Short term actions to be adopted in case of SAPE

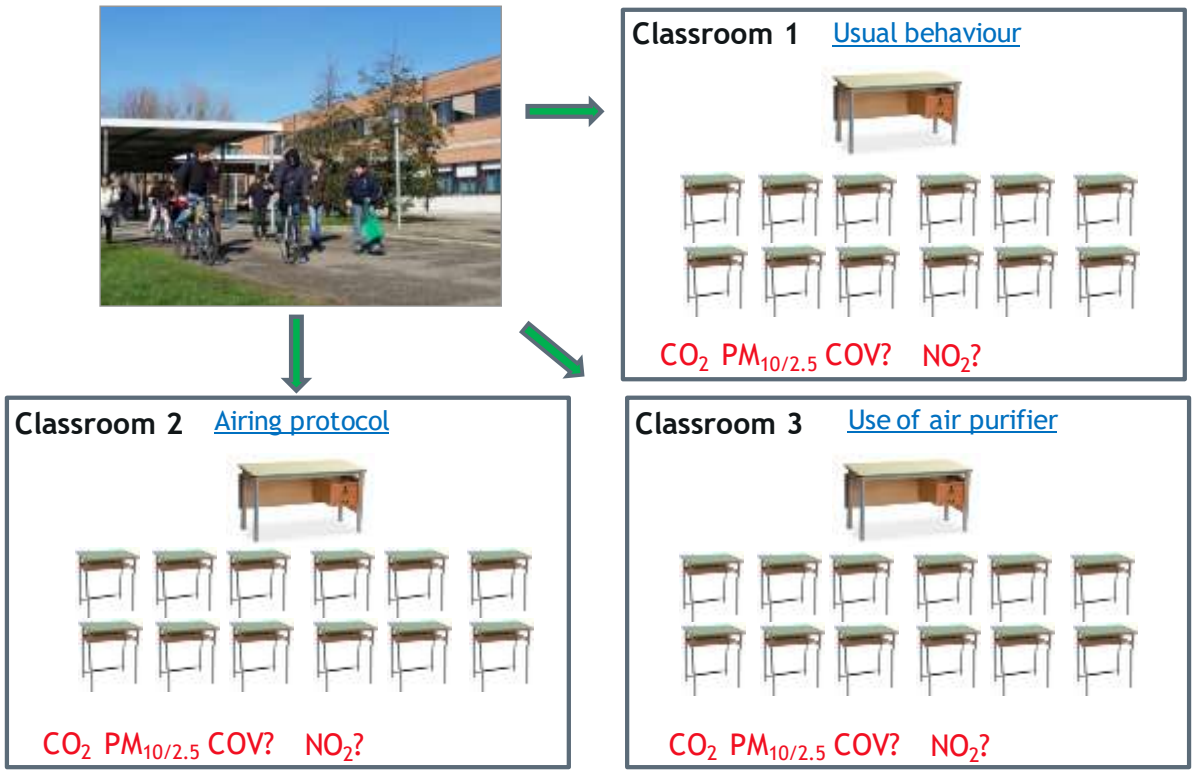
3.1.1 Pilot test 3. Reduction of children exposure to air pollutants in schools

Children can be considered a vulnerable group and the reduction of their exposure to air pollutants should be considered a primary goal. From this perspective, actions in schools could be important because exposure at school buildings represents a significant quota of the total children exposure and because in this way is it possible to reduction of exposure of a large number of children. While no significant emissions of air pollutants should be present in schools, significant reduction of exposure to pollutants of outdoor origin could be achieved with actions in schools. In particular, the goal of the project will consist in defining guidelines to be adopted by schools during SAPE. The guidelines will consider different aspects including suggestions about cleaning products and access to school couryards during SAPE. However, the focus will be on the different ways of airing and in particular how application of guidelines for opening and closing windows may help reduce exposure to air pollutants. One or more schools will be selected (the number will be established depending on instruments costs and availability of schools) to assess the reduction of exposure to air pollution of children that could be achieved by applying the guidelines Some tests will be also carried out to assess the beneficial effects in terms of exposure reduction that can be obtained with the installation of air purifiers in classrooms. The use of

purifiers and of the ventilation guideline will be limited to severe air pollution events. The application of the guidelines and the monitoring activities will be accompained by an educational programme on air quality and health including meeting with students, parents and teachers.

Criteria and methodologies to assess effectiveness

To evaluate the effect in terms of reducing children exposure to air pollution by following specific guidelines and scheduled manual airing procedures in school building during severe air pollution episodes. Protection from outdoor pollution will be assessed primarily comparing indoor and outdoor PM concentration. Indoor air quality will also be monitored in terms of PM10, PM2.5, PM1 and CO2 concentrations. NO2 and COV (Volatile Organic Compounds) will be possibly included in the measurement programme.



Three classrooms will be selected in each school. The classrooms should be as similar as possible in terms of volume, furniture and exposure to outdoor pollution sources. A monitor for PM (PM10 and/or PM2.5) and a monitor for CO2 will be placed in each classroom. Measurement of CO2 and

PM will be also performed outdoors close to the selected classrooms. In addition to this basic monitoring configuration it would be possible to consider a third classroom where a portable air purifier could be installed. Measurement will be collected contemporary in the different classrooms and carried out for several months (Dec-Feb). The periods with PM concentrations above standard will be extracted from the time series of measurements. Air quality in the different classrooms during the selected periods will be compared leading to an assessment of the effectiveness of the guideline (general tips, ventilation strategy and possibly the presence of air purifiers).

Roles assigned for the implementation of the pilot test

- *ARPAE*: installation of sensors in the identified schools and activities of analysis and data management
- *Municipality of Parma* - Environmental protection sector: contacts with schools and coordination of activities

Roles of stakeholders in pilot test implementation

- *Schools* (students, school staff, canteen operators): application of correct methods of ventilation of the rooms (opening and closing windows)

Time table

- *PHASE 1- Winter 2019-2020*

  September 2019: Start contacts with schools in the urban area of Parma and in the FUA.

  December 2019: Beginning of monitoring campaigns

- *PHASE 2- Winter 2019-2020*

  November 2020: New monitoring campaigns

3.1.2 Constitution of expert panels to draft and disseminate guidelines to be adopted by vulnerable people in the case of SAPEs

The definition of guidelines for vulnerable people during SAPE will represent another important adaptation action. Group of experts, mainly clinicians, will be involved in discussion groups in order to verify the possibility of setting up specific guidelines to be adopted by people having specific pathologies during SAPE. The focus will be on people that clinical and epidemiological studies have identified as most affected by air pollution episodes such as people suffering from cardiovascular and respiratory disease or chronic disease such as diabetes.

The guidelines will deal with different topics including:

- regulation protocols in the use of drugs for particular pathologies;
- vademecum containing good practices on the adoption of diets;
- adaptation measures to reduce the exposure of the categories of vulnerable people: cardiac, asthmatic, diabetic etc.

To realize this action we will organize working tables and coordination with experts. Associations will be involved to suggest experts and to support the dissemination and the use of the guidelines.

Criteria & methodologies to assess effectiveness.

Effectiveness of the action will be evaluated in terms of assessment of the possibility to define specific guidelines finalized and in terms of number of people/associations using them.

Roles assigned for the implementation of the pilot test

- *Arpae and Center for Environmental Ethics:* coordination of the involvement of the panels of experts
- *Municipality of Parma*: support in involvement of local expert and stakeholders, also through the organization of multilevel tables of co-design (ref. D.T1.1.1). Aim of this initiative is to create networks among stakeholders and to enhance discussion on health and air quality that will lead to find new strategies to improve the communication and awareness on SAPEs.

- *AUSL, doctors* collaboration in the definition and dissemination of the drugs protocol and vademecum diets

Time table

- *PHASE 1- Winter 2018-2019*

  November 2018: Start contacts with experts

  Beginning of 2019 (likely January or February): Definition of which specific guidelines the project intend to produce and definition of the composition of the international panels of experts for each guideline.

- *PHASE 2- Winter 2019-2020*

  September 2019: Mid term review of the work by the panel of experts. Decision of what panels should go on with producing the guidelines

  March 2020: Finalization of the guidelines

  May 2020: Meeting with local health authorities, associations, charities and health professionals to disseminate the guidelines.

3.2 Long and medium term actions

In the long and medium term adaptation actions will aim to increase people awareness about air pollutants effects on health and potential change behaviours to be adopted for reducing exposure. Educational activities and dissemination of guidelines for reduction of indoor exposure (with emphasis on cooking and use of houseplants) are planned as well. Dissemination and questionnaires for students on mobility, air quality and AWAIR project objectives are foreseen. Many presentations of the project are expected in training courses for teachers on Sustainable Mobility and Climate change events and activities for students will be organized.