

Deliverable D38 (D5.4) Guidelines and Training on Air Quality Tools



RI-URBANS

**Research Infrastructures Services Reinforcing Air
Quality Monitoring Capacities in European Urban &
Industrial AreaS (GA n. 101036245)**

By

UHEL, CSIC, TROPOS, INOE, CNR, CNRS, EMPA, FMI, IMT, INERIS, KNMI, NOA, VITO, RICARDO & IUTA



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Deliverable D38 (D5.4): Guidelines and Training on Air Quality Tools (source apportionment, mobile measurements, low-cost sensors, citizen science)

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1. About this document

This Deliverable (D38, D5.4) resulted from T5.2 on “*Establishment of the measurement quality framework supporting RI-URBANS services*” through/by (1) addressing quality assurance/quality control (QA/QC), traceability and standards of conducted measurements and ensuring knowledge transfer to relevant stakeholders (AQMNs – Air Quality Monitoring Networks, in particular); (2) supporting implementation of QA/QC measures in the pilots of WP4 in close connection with pilot leaders and the Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) Topical Centre (TC); (3) addressing technical framework for QA/QC related to new highly valuable AQ variables and tools developed in RI-URBANS; (4) compiling technical guidelines for AQ monitoring and assessment tools (such as source apportionment), mobile measurements or low-cost sensors; (5) addressing measurement-related knowledge transfer to AQMNs, through joint workshops with AQMNs and the European Network of National Air Quality Reference Laboratories (AQUILA) network; (6) developing shared RI-URBANS and AQUILA expert judgement on applicability of non-standard measurement methods and knowledge transfer towards AQMNs.

This report “*Guidelines and Training on Air Quality Tools (source apportionment, mobile measurements, low-cost sensors, citizen science)*” (D38 (D5.4)) provides summaries of a series of training events addressing harmonized measurements of emerging pollutants of the new Air Quality (AQ) directive, and in particular, trainings focused on aerosol particle number concentration (PNC), aerosol particle number size distribution (PNSD), and equivalent Black Carbon (eBC). It also provides summaries of a series of webinars/training events addressing service tools, mobile training monitoring, citizen science, and planned webinars on source apportionment and mapping, as well as RI-URBANS and webinars in collaboration with Green Deal Projects Support Office (GDP-SO) / ACTRIS (the Aerosols, Clouds and TRace gases Research InfraStructure; <https://actris.eu>); ATMO-ACCESS (*Sustainable Access to Atmospheric Research Facilities*; <https://www.atmo-access.eu>); AQUILA (*European Network of National Air Quality Reference Laboratories*) on such topics as: Knowledge & citizens working group meetings; Dialogue on selected European green deal policy priorities, Phenomenology of new air pollutants; Instruments and protocols to measure advanced air quality parameters; Implementing revised EU ambient air quality directive.

This is a public document that will be distributed to all RI-URBANS partners for their use and submitted to the European Commission as a RI-URBANS Deliverable D38 (D5.4). This document can be downloaded at <https://riurbans.eu/work-package-5/#deliverables-wp5>.

2. Series of guideline and training events addressing harmonized measurements of emerging pollutants

In November 2024 Directive (EU) 2024/2881 on ambient AQ and cleaner air for Europe has been published. This is connected to the European Union’s objective towards zero pollution by 2050 facilitating prevention of premature deaths due to air pollution. The new AQ Directive merges the 2004 and 2008 legislation and responds to the World Health Organization (WHO) recommendations on lower guideline standards and to monitor additional air pollutants, such as UFP, PNSD and eBC concentrations. The European Member States have two years to transpose the requirements of the new AQ Directive.

Numerous stakeholder meetings were organised by the RI-URBANS (<https://riurbans.eu>) project to offer guidelines for the implementation of the tools to measure the above novel pollutants. Two types of meetings were organised, the ones for disseminating and guiding stakeholders, and training events.

The RI-URBANS project also co-organized a series of training events (in January-February 2025) addressing harmonized measurements of emerging pollutants of the new AQ Directive with the AQUILA, ACTRIS, and the European Environmental Agency (EEA). The trainings were organized in a series of on-line sessions concentrating on different aspects of the emerging pollutants and AQ Directive requirements.



Schedule:

Training #1: 23 January 2025 09:30 – 11:30 CET Aerosol particle number concentration
Training #2: 27 January 2025 09:30 – 11:30 CET Aerosol particle number size distribution
Training #3: 11 February 2025 09:30 – 11:30 CET Equivalent Black Carbon

Target audience: AQUILA experts, but not restricted only to the AQUILA network.

Members of the organizing committee: Annette Borowiak, Tuukka Petäjä, Xavier Querol, Silvia Monge, Alfred Wiedensohler, Christoph Hüglin, Jean-Philippe Putaud, Marco Pandolfi, Wenche Aas, Christof Asbach, Wilma Travnicek, Brian Stacey.

2.1 Aerosol particle number concentration

According to the directive “2024/2881 on ambient AQ and cleaner air for Europe”, the ultrafine particles (UFP) is defined as particles with a diameter less than or equal to 100 nm, where UFP are measured as the particle number concentrations per cubic centimetre for a size range with a lower limit of 10 nm. Ambient UFP concentrations are measured with Condensation Particle Counters (CPCs) following existing standards. The RI-URBANS / ACTRIS has developed Service Tools (such as [ST1](#)) that facilitate implementation of UFP measurements by AQMNs.

The aim of the online training event on “*Aerosol particle number concentration*” was to provide a concise introduction to the requirements of the new AQ Directive, to describe the added value of implementing UFP measurements in urban supersites, to introduce the relevant measurement standards and to summarize the current state-of-the-art in UFP measurements, harmonization, calibration, maintenance and operations.

The agenda/ programme of the training (21 January 2025; with more than 200 participants) is available in Annex 7.1. Agenda included presentations and discussions/questions about introduction to new monitoring requirements; added value of pan-European UFP measurements; introduction to RI-URBANS / ACTRIS Service Tools; standard EN 16976 (2024) ambient air - determination of the particle number concentration of atmospheric aerosol; Ultrafine particle number concentrations (background, measurement harmonization, list of ACTRIS compliant instruments, other sensors / instruments, types of instruments, advantages, approximate pricing, required maintenance and expertise, contact details, quality assurance / quality control, sampling and sample conditioning); experiences from a monitoring network operating CPCs.

Both, the [slides of presentations/talks](#) delivered & the [video recording](#) (about 2h) of the training are publicly available. [Materials of the training](#) were disseminated through the RI-URBANS public website.

2.2 Aerosol particle number size distribution

According to the directive “2024/2881 on ambient AQ and cleaner air for Europe”, ultrafine particles (UFP) is defined as particles with a diameter less than or equal to 100 nm. Particle number size distribution (PNSD) of the UFP should be measured with a lower size limit of 10 nm. The size distribution of UFP is measured with standardized Mobility Particle Size Spectrometer (MPSS) instruments. The RI-URBANS / ACTRIS has developed Service Tools (STs) that facilitate implementation of UFP PNSD measurements by AQMNs.

The aim of this online training event on “*Aerosol particle number size distribution*” was to provide a brief introduction to the added value of aerosol number size distribution measurements, to introduce the relevant measurement standards and to summarize the current state-of-the-art in UFP number size distribution measurements, harmonization, calibration, maintenance and operations.

The agenda/ programme of the training (27 January 2025; with more than 180 participants) is available in Annex 7.2. Agenda included presentations and discussions/questions about added value of aerosol particle number size distribution measurements; standardization CEN/TS 17434 (2020) ambient air - determination of PNSD of atmospheric aerosol using a MPSS; PNSD of UFP (background, RI-URBANS / ACTRIS STs, examples from GUAN network, instrument white-list, types of instruments, advantages, prices, maintenance, expertise, quality assurance / quality control); experiences from AQMNs in implementation of UFP PNSD measurements, challenges associated with requirements of data availability.

Both, the [slides of presentations/talks](#) delivered & the [video recording](#) (about 1h 45 min) of the training are publicly available. [Materials of the training](#) were disseminated through the RI-URBANS public website.

2.3 Equivalent Black Carbon

According to the directive “2024/2881 on ambient AQ and cleaner air for Europe”, black carbon (BC) is defined as a carbonaceous aerosol measured by its light absorption. The directive addresses BC as an air pollutant of emerging concern and recommends BC to be measured at supersites in urban and, at least, half of the rural supersite locations co-located with other air pollutants. There are no current standard methods in BC measurements. However, ACTRIS has harmonized equivalent BC (eBC) measurements in their pan-European measurement network. The definitions and methodologies for deriving atmospheric eBC concentrations from optical measurements are described in RI-URBANS Service Tool 2 (ST2) on Black Carbon. More information about other STs is available at: <https://riurbans.eu/project/#service-tools>.

The aim of this online training event on “*Equivalent Black Carbon*” was to provide a brief introduction to the added value equivalent BC measurements, to introduce the relevant measurement standards and to summarize the current state-of-the-art in eBC measurements, harmonization, calibration, maintenance and operations.

The agenda/ programme of the training (11 February 2025; with more than 220 participants) is available in Annex 7.3. Agenda included presentations and discussions/questions about added value of eBC measurements, definition, background, obligatory measurements at supersites, RI-URBANS/ACTRIS Service Tools, ACTRIS list of compliant instruments, different instruments, advantages and disadvantages, approximate prices, maintenance and expertise needs, quality assurance / quality control, data reporting; experiences from AQMNs on eBC measurements.

Both, the [slides of presentations/talks](#) delivered & the [video recording](#) (about 2h) of the training are publicly available. [Materials of the training](#) were disseminated through the RI-URBANS public website.

3. Series of webinars/training events addressing service tools, mobile monitoring, citizen science

3.1 Launching 17 Novel Air Quality Documents and 16 Service Tools

On April 16th 2025, the EU Horizon-2020 RI-URBANS project hosted successful webinar to announce the release of sixteen [Guidance Documents](#) for the implementation of measurements and modelling for novel air quality pollutants, in particular, the 16 Service Tools (STs) and a booklet summarizing their purpose and the added value of implementing them. This short webinar will provide a brief introduction to RI-URBANS, the Service Tools and the “Summary and Added Value” booklet.

The event attracted 237 participants from research institutes, universities, and various stakeholder organizations. This event is part of the RI-URBANS project in connection with the new European Air Quality Directive (EU) 2024/2881. The developed (by RI-URBANS in collaboration with [ACTRIS](#)) guidance documents cover STs for enhanced air quality assessments. These STs provide actionable recommendations for supersites, including guidance on measurements, source apportionment, health assessment, mapping, and modelling.



The webinar opened with a presentation by Xavier Querol (RI-URBANS PI), who introduced the project, outlined the newly launched [Service Tools](#), and provided an overview of the “Summary and Added Value” [booklet](#). In the second half, Co-PI Tuukka Petäjä discussed the collaboration between RI-URBANS, ACTRIS, AQUILA, EEA, and the European Monitoring and Evaluation Programme (EMEP), highlighting joint training initiatives. The session concluded with an engaging discussion between the PIs and the audience.

- [Webinar Video](#)
- [Presentation by PI Xavier Querol](#)
- [Presentation by co-PI Tuukka Petäjä](#)

3.2 Mobile Monitoring Training in Warsaw, Poland

On September 4th and 5th, 2024, an onsite mobile monitoring training (presentation + monitoring test run) was provided to volunteers from the University of Warsaw (Warsaw, Poland). This training resulted in a replication action of the mobile mapping service tool in Warsaw (summer and winter campaign) and yielded comparative results on fine-scale spatial-temporal pollution variability in the city of Warsaw.



Mobile air quality mapping has been performed for black carbon (BC), ultrafine particles (UFP) and particulate matter (PM_{2.5}) to assess the spatial pollutant variability in Warsaw, evaluate source impacts and improve commuter exposure assessment. The measurement set-up is based on the mobile monitoring approaches developed within RI-URBANS. Voluntary participants performed bicycle measurements with portable equipment along a dedicated sampling route during morning (8-9h) and evening (17-18h) rush hours. The monitoring campaigns were performed during the warm (40 runs between September 6th-October 9th, 2024) and cold (42 runs between January 22nd - March 5th, 2025) season. Prior to the mobile campaigns, the portable instruments (Aethlabs AE51, Naneos Partector 2.0, OpenSeneca) were co-located with high-end instruments at the WOS site for UFP and BC and the local AQMS for PM. GPS localization was provided by a Garmin Forerunner 55 watch.

The collected data/ dataset are available in an open data repository (Hofman *et al.* 2025; <https://doi.org/10.18150/MYFYSJ>). The dataset includes the raw high-resolution (1-second) data of the portable instruments collected during the mobile monitoring campaigns and merged to seasonal (summer/winter) datafiles based on datetime stamps. This data is currently further processed to construct high-resolution concentration maps as described in the RI-URBANS ST for urban mapping (ST13).

3.3 RI-URBANS & Knowledge Citizens Working Group

RI-URBANS participated in the 1st Knowledge and Citizens Working Group meetings (15 June 2022), organised by the [Green Deal Projects Support Office](#). The RI-URBANS coordinator Xavier Querol and project manager Marta Monge this event. An action plan was developed with other Green Deal projects in order to achieve maximised positive impacts in the long-term future. The meeting was organised to facilitate the coordination between projects funded under the Horizon 2020 Green Deal Call and maximise their positive impact in the longer term. The meeting aimed to bring together all the knowledge and citizens task force projects to get to know each other, identify and prioritise commonalities to propose and create synergies between the 16 projects. In addition, the meeting also served to start developing the action plan and to advance the identification of key activities.

Their common focus is to strengthen citizens' awareness of their own role as actors of change, promoting inclusive and participatory approaches to decision and policymaking at the local and national levels to address climate change challenges and propose transdisciplinary approaches to behavioural change.

During the event, there were joint sessions with several of these projects. The European Commission envisaged technical synergies of RI-URBANS with ICOS CITIES (Integrated Carbon Observation System; <https://www.icos-cp.eu/projects/icos-cities/>) PAUL (Pilot Application in Urban Landscapes - Towards integrated city observatories for greenhouse gases; <https://www.icos-cities.eu>), CIRCULAR FOAM (Systemic expansion of territorial CIRCULAR Ecosystems for end-of-life FOAM; <https://circular-foam.eu>), and FRONTSH1P (A FRONTrunner approach to

Systemic circular, Holistic & Inclusive solutions for a new Paradigm of territorial circular; <https://frontsh1p.eu> projects in terms of providing citizens with information systems and tools to support decision-making in both pollution monitoring and circular economy solutions adoption.

From RI-URBANS project side the suggested synergies and support are: (1) engaging RI-URBANS with both Directorates-General for Environment (DG ENV) and for Health and Food Safety (DG SANTE) of the European Commission; (2) using RI-URBANS' tools, developed within WP2, for citizen science; (3) linking the pilot studies of different projects that are simultaneously carried out in European cities (i.e. the Paris pilot studies, from ICOS CITIES /PAUL and RI-URBANS projects); and (4) potentiating joint dissemination of results with other projects and ensure there are no contradictions. Information about the meeting was disseminated through the RI-URBANS public [website news](#) and the Green Deal Support Office [webpage](#). Raffaelli et al. (2025) provides a summary/ report on knowledge and citizens.

RI-URBANS participated in the 2nd Knowledge and Citizens Working Group meetings (18 November 2022), organised by the [Green Deal Projects Support Office](#). Tuukka Petäjä (JHEL) attended as RI-URBANS representative. Agenda of the meeting included: Introduction and objectives of the meeting; Action Plan: Presentation of the Plan and Focus Areas; Discussion and feedback on the Action Plan; Decision-making on Action roles; Mentimeter poll to select the Action leaders and Action groups; Executive updates from projects; Presentation of the GD-SO updates and Communication activities; Wrap up and next steps. At start, topics about developed Action Plan, general impressions and identification of action leaders and groups, general updates from projects, setup basis for implementation, and next steps were presented and discussed.

Moreover, the Knowledge sharing platform, Policy influence, Stakeholder engagement, Case study and good practice criteria were discussed, incl. feedbacks on action plan, executive updates from projects, GD-SO updates and activities, communications updates and key activities foreseen, followed up by a wrap up and next steps. Note the following actions were planned for the Knowledge sharing: (1) create an interactive map with a timeline summarizing the information, to be publicly available, intuitive and in the form of a living document & (2) exploit information obtained in the mapping exercise and realise joint events in common project areas; for the Policy influence: (1) elaborate shared policy brief(s) and recommendation(s) & (2) monitor and participate in events and activities related to influencing policy; for the Stakeholder engagement: (1) development of a compendium of stakeholder and citizen engagement methods & (2) produce a guidance document on the best practices to engage vulnerable groups; for the Case studies and good-best practice: (1) methodological framework for best practices & (2) good practice portfolio of case studies.

The RI-URBANS project provided positive feedback towards the Action Plan, especially, RI-URBANS can contribute to some actions described and can participate in the formulation of guidelines and best practices.

RI-URBANS participated in the 6th Knowledge and Citizens Working Group meetings (13 November 2024), organised online by the [Green Deal Projects Support Office](#). Martine Van Poppel (VITO) attended as RI-URBANS representative. Agenda of the meeting included: updates on communication, updates next steps on citizen science policy briefs (key takeaways, challenges, etc. with discussions), updates from projects involved (in particular, RI-URBANS shared [ST13](#) on Mapping ultrafine particles and citizen science), foreseen activities in coming months (action plan, proposed new activities), and next steps, planning and feedback, and discussions (in particular, RI-URBANS suggested to overview on which methodologies to use, not only how to engage citizens but also recommendations on measurement methodology, based on expertise from existing projects). See more details in the RI-URBANS document "[Minutes of the 6th Knowledge & Citizens WG Meeting](#)".

RI-URBANS participated in the 7th Knowledge and Citizens Working Group meetings (22 April 2025), organised online by the [Green Deal Projects Support Office](#). Xavier Querol (CSIC) and Martine Van Poppel (VITO) attended as

RI-URBANS representatives. Agenda of the meeting included: recap of brainstorm activity, result of questionnaire (main key topics - behavioural change, CS and education), key impacts observed from projects, key target audiences identified, key barriers and challenges; communication updates (quarterly newsletter, social media, PR campaigns, success stories, latest published articles), and discussions. See more details in the RI-URBANS document "[Minutes of the 7th Knowledge & Citizens WG Meeting](#)".

3.4 Webinar on Dialogue on Selected European Green Deal Policy Priorities

RI-URBANS participated in workshop on **Dialogue on selected European Green Deal Policy Priorities: Questions in advance, Climate Action**" (12 January 2023), organised by the Green Deal Projects Support Office. Martine Van Poppel (VITO) attended as RI-URBANS representative. Projects financed under the Green Deal Calls (GDC), in total 73, are supported by the Green Deal Projects Support Office (GD-SO) with an aim of enhancing synergies, ensuring collaboration and sharing of project results. During planned meetings, project coordinators expressed the need for more detailed information about the Commission policy priorities in their respective areas (climate change, biodiversity, clean energy, food, health, and urban environment and mobility). RI-URBANS contributed with the STs on urban mapping of pollutants and the citizen involvement.

The webinar main objective is to provide detailed information about the Commission policy priorities related to the implementation of the selected European Green Deal policies and to outline the ways in which projects supported by the GD-SO can contribute to the implementation of these policies. Further aim is to enable project coordinators to have an open discussion with the policy officers and to gain a better understanding of the possible ways their project results can feed into the Commission policy processes, particularly those that are planned for the coming years when projects financed under the Green Deal Call will start having tangible results. In the same way, the event will give policy officers the possibility to directly interact with the projects during the open discussion and ask questions. Agenda of the meeting included: European Green Deal policy priorities for the year ahead' Citizen participation: Citizen engagement initiatives at the Commission; break-out parallel sessions on climate action; biodiversity; clean, affordable and secure energy; food and agriculture; health; mobility.

For RI-URBANS, within the Climate Action, the revision of the CO₂ emission standards for cars and vans might be of interest. The online platform EU citizen Science (<https://eu-citizen.science>) already shares knowledge, tools, training, and resources for citizen science at European levels, and it works as a Knowledge Hub. It could be useful to include RI-URBANS in this website database as well as add the relevant deliverables or milestones developed in the project. See more details with agenda/ programme of the event in the RI-URBANS document "[GDSO Workshop – Dialogue on selected European Green Deal Policy Priorities](#)".

3.5 Webinar on Phenomenology of New Air Pollutants co-organised with the Green Deal Support Office

RI-URBANS co-organized webinar on **Phenomenology of the New Air Pollutants (4 December 2023)** with the Green Deal Support Office included in the proposal for a new EU Air Quality Directive. The context is that air quality in Europe has markedly improved in the last two decades as a consequence of the policy actions implemented at European, National, Regional and Local levels. In parallel, advances in the scientific knowledge have uncovered that negative health effects can be experienced at even lower ambient concentrations of air pollutants than previously expected. This is because some air pollutants, such as particulate matter (PM) and nitrogen dioxide (NO₂), can lead to both short-term and long-term health problems. Consequently, the 2021 WHO air quality guidelines and their use for the subsequent elaboration of a draft for a new EU air quality directive are currently under discussion.

The objectives of the webinar included: (1) to share knowledge between EU research projects working on the phenomenology of new pollutants included in the proposed EU Air Quality Directive, bringing together both the Green Deal Call (GDC) and non-GDC projects; (2) to highlight to policymakers the most recent research and thinking on the key sources of new pollutants, trends in their source contributions, and methods to model and take inventory

of these pollutants, establishing a foundation for further information exchange; and (3) to emphasise how these air quality standards impact citizens, and what they can do (and have done) to contribute to policy development.

The RI-URBANS project delivered presentation of phenomenology of ultrafine particles, black carbon, oxidative potential & ammonia in urban Europe (Xavier Querol, CSIC). The agenda/ programme of the webinar included two sessions (I - New pollutants' trends in source contributions, and methods to model and take inventory of them & II - Air quality standards impact on citizens, and their role in measuring air quality), and it is available in Annex 7.4.

This [webinar can be reproduced](#) online in the GD-SO website. Note that more than 450 interested participants were registered but about 250 attended due in part to a GD-SO error in the link of the webinar.

3.5 Webinar on Instruments and Protocols to Measure Advanced Air Quality Parameters

Webinar on Instruments and Protocols to Measure Advanced Air Quality Parameters (10 January 2024) as online meeting / webinar to discuss instruments and protocols to measure advanced air quality (AQ) parameters for the urban RI-URBANS/ ACTRIS supersites with the AQUILA community. The event took place online on 10th January 2024. One of the outputs of RI-URBANS is providing guidance documents for specific STs for the upscaling of the measurements across urban Europe. To this end, RI-URBANS is reviewing the CEN and ACTRIS recommendations, when available, for the instrumentation and measurement protocols, and directly including these in the guidelines. The scope of this online meeting - to present and jointly discuss with AQUILA the instrumentation and protocols that RI-URBANS/ACTRIS are proposing for a number of advanced AQ parameters including UFP, PSD, BC, VOCs and NH₃. The presentations showed the different degree of harmonisation potential for the different STs. From the UFP-PNSD with CEN methods and ACTRIS recommendations already available to NH₃ and VOCs with still work required to suggest methods or with only CEN methods available for offline methods. As a consequence, we agreed to have three types of STAGES as regards the guidelines from RI-URBAN/ACTRIS for STs in urban areas and AQ.

The structure of the recommendations for each of these pollutants will include the following: (1) definition of the specific advanced AQ parameter; (2) origin, variability (time and spatial); (3) urban Pan-European report of the specific parameter showing the added value of the measurements; (4) information on measurement methods and quality control (state of evolution for harmonisation; description of the methods to be recommended; and data management): Review and summarise and link the EBAS data requirements for each parameter.

The agenda/ programme of the webinar – included a series of presentations on suggested instruments and protocols for UFP, PSD, BC, VOCs and NH₃ followed by discussions – is available in Annex 7.5. See more details in the RI-URBANS document “[Report on the Meeting RI-URBANS-ACTRIS-AQUILA](#)”.

3.6 Webinar on Implementing Revised EU Ambient Air Quality Directive

Webinar on how to implement revised EU Ambient Air Quality Directive (4 October 2024) as a collaborative effort of RI-URBANS, ACTRIS and ATMO-ACCESS focused on introduction of the mentioned projects, added value of measuring “new” pollutants - guidance and monitoring and reference methods for Ultra-fine Particles and Particle Number Size Distribution (UFP and PNSD), Volatile Organic Compounds (VOCs), speciation of Particulate Matter (PM) and Black Carbon (BC) and followed by questions (vs. answers) and feedbacks from audience as well as conclusions.

The agenda/ programme of the webinar – included a series of presentations on guidance, monitoring and added value of measuring new pollutants such as UFP and VOCs, speciation of PM and BC – is available in Annex 7.6.

3.7 Other Events and Activities

• **The 1st Stakeholder Meeting** (online, 30 May 2022) with 57 attendees succeeded in involving staff of EC-DG ENV, AQUILA, WHO, EEA, WMO, EMEP (the first 3 giving talks) as well as numerous cities. It showed the advancements

in RI-URBANS' pilot activities. Also, in the [1st RI-URBANS Science Meeting](#) (hybrid, 19-20 October 2022) in Barcelona, Spain. This hybrid meeting gathered a total of 150 participants from 63 different institutions to inform about the ongoing work.

- **The 2nd Stakeholder Meeting** (hybrid, February 2023) was organized and carrying out in Warsaw, Poland. The Polish stakeholders representing in total 23 institutions attended including 16 institutions with representatives in person (20 persons) and 9 institutions online (11 persons). In addition to Polish stakeholders, in this meeting also 6 representatives of the RI-URBANS and the ATMO-ACCESS projects have participated (6 online & 1 onsite).
- **The remote conference on RI-URBANS** (online, December 2022) was given to EC-DG-ENV, JRC and EEA staff, by request of EC-DG-ENV to supply information for the review of the EU AQ Directive. Subsequently, information packages on the RI-URBANS service tools of advanced AQ parameters were supplied to C. Nagl working for the review of the AQ Directive. Most of these STs are included in the AQ Directive (EU) 2024/2881.
- **The 3rd Stakeholder Meeting** (online, 19 June 2023) of RI-URBANS was [organised in collaboration](#) with ACTRIS, AQUILA and EMEP to discuss with AQUILA and national AQMNs experts the recommendations sent to DG ENV-EC for the review of the new AQ Directive. In total, 152 persons from 69 institutions attended the meeting. These included DG ENV, WHO, WMO, ACTRIS, EMEP, AQUILA, RI-URBANS, and AQ national experts from numerous countries, regions and cities, RI-URBANS Associated Collaborators, national research centres and SMEs.
- **The Air Quality Stakeholder Webinars** (online, 4 & 22 October 2024) were organized by ATMO-ACCESS & RI-URBANS. The guidance for STs for advanced AQ parameters (most included in the new AQ Directive) and guidance on implementing the STs from RI-URBANS/ACTRIS were presented.
- **The Italian Stakeholder Meeting on Air Quality** (hybrid, 7-8 April 2025) was organised in Rome, Italy. 120 participants attended the event onsite, including representatives from 14 ARPAs and ISPRA, and 60 participants were connected remotely.
- **The RI-URBANS Service Tools** presented (24-25 April 2025) to the Ministry for Ecological Transition and the managers of the AQMNs of Spain.
- **The 1000 printed copies of RI-URBANS of booklet** (30 April 2025) / [summary report](#) of the 16 STs that have been distributed among stakeholders. AXA Research Fund supported the publication costs.
- **The RI-URBANS Service Tools** presented in the 26th Annual Meeting of the Task Force on Measurements and Modelling (TFMM) in Potsdam, Germany (5-7 May 2025). [See link](#). This event was organised under the framework of the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) and is a key component of the European Monitoring and Evaluation Programme (EMEP).
- **The RI-URBANS results from health outcomes of the exposure to the novel pollutants** were presented at WHO in the 28th meeting (online, 20-21 May 2025) of the Joint Convention/WHO Task Force on the Health Aspects of Long-range Transboundary Air Pollution. [See link](#).
- **Meeting “La nueva Directiva Europea de Calidad del Aire”** organized by the Ecologistas en Acción (NGO) in Madrid, Spain (onsite, 30 May 2025). [See link to the video](#).
- **The RI-URBANS results in DG ENV Headquarters** as a face-to-face event, with the participation of EEA, AQUILA, and JRC staff in Brussels, Belgium (onsite, 18 June 2025).
- **The RI-URBANS Interaction with AQUILA and RICARDO** on elaborating [recommendations](#) for such type of measurements for DG ENV. RI-URBANS sent them all the guidance documents produced for these advanced AQ parameters. The [second draft of these DG-ENV documents](#) in July 2024 RICARDO-driven consortium sent the draft

documents to RI-URBANS for comments. A complete list of comments was sent on 4th September 2024 to this consortium. The [final DG ENV report](#) on monitoring to support the implementations of the NAQD was made publicly available in May 2025. It contains 29 references to RI-URBANS STs for recommending implementing the measurements of Article 10 of the NAQD-2024/2881. Special relevance is given to RI-URBANS guidance documents on measurements of UFP, PNSD, BC, PM speciation, NH₃, OP, VOCs. Thus, all AQMNs will have access to RI-URBANS guidance documents for STs through this official document. Also 2 references to RI-URBANS STs are included in the [twin DG report](#) on modelling.

- **The RI-URBANS Service Tools** (booklet and selected guidance documents) will be published during 2025 with a help (covering costs of the translation to Spanish) from the Ministry for Ecological Transition of Spain. The most relevant guidance STs will be selected & included/linked on the website of the Ministry. [See example in Spanish following link.](#)

4. Forthcoming trainings

The RI-URBANS Stakeholders' Final Webinar will be held online on 10th September 2025, where the 17 published guidance documents will be presented.

Moreover, a series of **webinars/ trainings** will be arranged for stakeholders in the second part of September 2025 by RI-URBANS **on Source Apportionment and on Mapping**. The main topics of the webinar on Source Apportionment will be the following: source apportionment for PM based on off-line and high time resolution data, and source apportionment of eBC, UFP, OP and VOCs. The main topics of the webinar on Urban mapping will be the following: citizen involvement and motivation, mobile monitoring, stationary sensor network, and combined approaches. The preliminary agendas for these events are currently in development.

5. Sum up

As summarized in section 2, during January-February 2025, a series of online training events addressing harmonized measurements of emerging pollutants was organized with focus on aerosol particle number concentration (PNC), aerosol particle number size distribution (PNSD), and equivalent Black Carbon (eBC) measurements. On average, around 200+ participants attended each of these events (about 2h online each).

As summarized in section 3, on 16 April 2025, 17 Novel Air Quality Documents and 16 Service Tools were launched during RI-URBAN webinar. During 4-5 September 2024, onsite (Warsaw, Poland) mobile monitoring training was provided to volunteers. RI-URBANS participated in the Knowledge & Citizens working group meetings (15 June 2022, 18 November 2022, 13 November 2024, 22 April 2025) arranged by the Green Deal Projects Support Office (GDP-SO) and co-organized Webinar on Dialogue on selected European Green Deal policy priorities (12 January 2023). RI-URBANS jointly with ACTRIS, AQUILA, ATMO-ACCESS co-organized a series of webinars: Phenomenology of new air pollutants (4 December 2023), Instruments and protocols to measure advanced air quality parameters (10 January 2024), Implementing revised EU ambient air quality directive (4 October 2024), and other events and activities where the RI-URBANS project was also involved.

Materials of the webinars/ trainings were disseminated through the RI-URBANS public website, slides of presentations/talks delivered and the video recording of the trainings are publicly available (see links provided in sections of the Chapters 2-4) as well as agendas/ programmes are available in Annexes.

6. References

- Hofman, Jelle; Van Laer, Jo; Okraska, Igor; Winkowski, Mateusz; Karasewicz, Maciej; Rykowska, Zuzanna; Kumala, Wojciech; Van Poppel, Martine; Stachlewska, Iwona S., **2025**, "Mobile measurements of black carbon (BC), ultrafine particles (UFP) and particulate matter (PM2.5) collected by cyclists in Warsaw, Poland", <https://doi.org/10.18150/MYFYSJ>, RepOD, V1 (last accessed 20 June 2025)
- Raffaelli, Viola; James Roscoe, Gabrielle Galassi, Tsvetelina Filipova (2025): Working Group Report: Knowledge and Citizens. Green Deal Projects Support Office, 20p. ISBN 978-92-68-14506-7; Jan 2025; doi: 10.2777/14313; <https://apre.it/wp-content/uploads/2025/01/working-group-report-KI0924236ENN.pdf> (last accessed 20 June 2025)

7. Annexes (agendas/ programmes of the events)

7.1 Agenda of Training on Aerosol particle number concentration



Training event #1: On-line training event on aerosol particle number concentration

23.1. 2025 09:30 – 11:30 CET

Link to join the event: <https://ecconf.webex.com/ecconf-en/j.php?MTID=md6586c660fa859c08913c30f74f062c0>

Aerosol number concentration

According to the directive “2024/2881 on ambient air quality and cleaner air for Europe”, ultrafine particles or “UFP” is defined as particles with a diameter less than or equal to 100 nm, where UFP are measured as the particle number concentrations per cubic centimetre for a size range with a lower limit of 10 nm.

Ambient UFP concentrations are measured with Condensation Particle Counters following existing standards. RI-URBANS / ACTRIS has developed Service Tools that facilitate implementation of UFP measurements by air quality monitoring networks.

The aim of this training event is to provide a concise introduction to the requirements of the new air quality directive, to describe the added value of implementing UFP measurements in urban supersites, to introduce the relevant measurement standards and to summarize the current state-of-the-art in UFP measurements, harmonization, calibration, maintenance and operations.

Agenda: 23.1.2025 (all times are Central European Time, CET)

09:30 – 09:40	Annette Borowiak: Introduction to new monitoring requirements
09:40 – 09:50	Xavier Querol: Added value of pan-European UFP measurements
09:50 – 10:00	Tuukka Petäjä: Introduction to RI-URBANS / ACTRIS Service Tools
10:00 – 10:10	Christof Asbach: Standard EN 16976 (2024) Ambient air - Determination of the particle number concentration of atmospheric aerosol.
10:10 – 10:55	Alfred Wiedensohler: Ultrafine particle number concentrations: Background, measurement harmonization, list of ACTRIS compliant instruments, other sensors / instruments, types of instruments, advantages, approximate pricing, required maintenance and expertise, contact details, quality assurance / quality control, sampling and sample conditioning
10:55 – 11:05	Brian Stacey: Experiences from a monitoring network operating CPCs
11:05 – 11:30	Discussions and questions

Additional information:

ACTRIS: <https://actris.eu>

RI-URBANS Service Tools: <https://riurbans.eu/project/#service-tools>

7.2 Agenda of Training on Aerosol particle number size distribution



Training event #2: On-line training event on aerosol particle number size distribution

27.1. 2025 09:30 – 11:30 CET

Link to join the event: <https://ecconf.webex.com/ecconf-en/j.php?MTID=mf377ccd06cf5f8be2a6d93aa9c09ac64>

Aerosol particle number size distribution

According to the directive “2024/2881 on ambient air quality and cleaner air for Europe”, ultrafine particles (UFP) is defined as particles with a diameter less than or equal to 100 nm. Particle number size distribution of the UFP should be measured with a lower size limit of 10 nm.

The size distribution of UFP is measured with standardized Mobility Particle Size Spectrometer (MPSS) instruments. RI-URBANS / ACTRIS has developed Service Tools that facilitate implementation of UFP particle number size distribution measurements by air quality monitoring networks.

The aim of this training event is to provide a brief introduction to the added value of aerosol number size distribution measurements, to introduce the relevant measurement standards and to summarize the current state-of-the-art in UFP number size distribution measurements, harmonization, calibration, maintenance and operations.

Agenda: 27.1.2025 (all times are Central European Time, CET)

09:30 – 09:40	Tuukka Petäjä and Annette Borowiak: Introduction
09:40 – 09:45	Xavier Querol: Added value of aerosol particle number size distribution measurements
09:45 – 09:55	Christof Asbach: Standardization: CEN/TS 17434 (2020) Ambient air - Determination of the particle number size distribution of atmospheric aerosol using a Mobility Particle Size Spectrometer (MPSS)
09:55 – 10:40	Alfred Wiedensohler: Particle number size distribution of ultrafine particles: Background, RI-URBANS / ACTRIS service tool, examples from GUAN network, instrument white-list, types of instruments, advantages, prices, maintenance, expertise, quality assurance / quality control
10:40 – 10:50	Christoph Hüglin: Experiences from air quality monitoring network in implementation of UFP particle number size distribution measurements, challenges associated with requirements of data availability
10:50 – 11:30	Discussion and questions

Additional information: ACTRIS: <https://actris.eu> RI-URBANS Service Tools: <https://riurbans.eu/project/#service-tools>

7.3 Agenda of Training on Equivalent Black Carbon



Training event #3: On-line training event on equivalent Black Carbon (BC) measurements

11.2.2025 09:30 – 11:30 CET

Link to join the event: <https://ecconf.webex.com/ecconf-en/j.php?MTID=m3068a3f074449ee4c6d8d352a0b47660>

Equivalent Black Carbon (BC)

The air quality directive (2024/2881) defines ‘black carbon’ (BC) as a carbonaceous aerosol measured by its light absorption. The directive addresses BC as an air pollutant of emerging concern and recommends BC to be measured at supersites in urban and at least half of the rural supersite locations co-located with other air pollutants.

There are no current standard methods in BC measurements. However, ACTRIS has harmonized equivalent BC measurements in their pan-European measurement network.

The definitions and methodologies for deriving atmospheric equivalent BC concentrations from optical measurements are described in RI-URBANS Service Tool 2.

Agenda: 11.2.2025 (all times are Central European Time, CET)

- | | |
|---------------|---|
| 09:30 – 09:40 | Tuukka Petäjä, Annette Borowiak: Introductions |
| 09:40 – 09:50 | Jean-Philippe Putaud: Added value of equivalent BC measurements and the bumpy road to a definition of BC |
| 09:50 – 10:55 | Marco Pandolfi: Equivalent Black carbon, background, definition of BC, obligatory measurements in supersites, RI-URBANS / ACTRIS Service Tools, ACTRIS list of compliant instruments, different instruments, advantages and disadvantages, approximate prices, maintenance and expertise needs, quality assurance / quality control, data reporting |
| 10:55 – 11:10 | David Green: Experiences from the air quality monitoring networks on equivalent BC measurements |
| 11:10 – 11:30 | Discussions and questions |

Additional information:

ACTRIS: <https://actris.eu>

RI-URBANS Service Tools: <https://riurbans.eu/project/#service-tools>

7.4 Agenda of Webinar on Phenomenology of New Air Pollutants

Time	Agenda Item
10:20	Web connexion opens
10:30 - 10:35	Welcome and introduction from the Green Deal Projects Support Office
10:35 - 11:00	INTRODUCTORY SESSION - EU Ambient Air Quality Directive and air pollutants of emerging concern" (<i>Lucia BERNAL-SAUKKONEN, DG ENV</i>) - Closing the loop: good practice statements in WHO global air quality guidelines" (<i>Roman PEREZ-VELASCO, WHO-Bonn</i>)
11:00 - 12:10	EXPERIENCES AND INSIGHTS OF PROJECTS <i>I - New pollutants' trends in source contributions, and methods to model and take inventory of them</i> - RI-URBANS : Phenomenology of ultrafine particles, black carbon, oxidative potential & ammonia in Urban Europe. <i>X. QUEROL and T. PETÄJÄ</i> - STARGATE : Ultrafine particles in and from airports. <i>J. PETERS</i> - n-PETS : Ultrafine particles from transportation. <i>F. AMATO</i> - PREPAIR : PM source apportionment. <i>E. CUCCIA</i> - LIFE REMY : Reducing uncertainties from emission inventories. <i>G. MAFFEIS</i> <i>II - Air quality standards impact on citizens, and their role in measuring air quality</i> - CiteS-GHealth : Mapping of urban pollution for epidemiological studies. <i>X. BASAGAÑA</i> - CompAir : Community Observation Measurement & Participation in AIR Science. <i>L. RAES</i> - RI-URBANS : Mapping of new pollutants & citizens science. <i>M. VAN POPPEL, G. HOEK</i>
12:10 - 12:30	QUESTIONS, DISCUSSION & WRAP UP – How can projects' results support the revision and implementation of the EU Air Quality Directive?

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7.5 Agenda of Webinar on Instruments and Protocols to Measure Advanced Air Quality Parameters



Online meeting to discuss instruments and protocols to measure advanced air quality parameters for the urban RI-URBANS/ACTRIS supersites with the AQUILA community.

PROGRAMME

10^h January 2024

[Link](#)

Meeting link from 9.50:00 h CET. All timing refers to CET

10:00-10:10 **Welcome and short presentation of the scope.** X. Querol and T, Petäjä

MEASUREMENTS OF PNC AND PNSD

10:10-10:25 **Instruments and protocols suggested** A. Alastuey

10:25-10:40 **How quality controls for UFP and PNSD should be implemented** A. Wiedensohler

MEASUREMENTS OF BC

10:40-11:00 **Instruments and protocols suggested** M. Pandolfi

11:00-11:30 **Discussion on the application of MAC** Chaired by A. Wiedensohler

MEASUREMENTS OF VOCs

11:30-11:45 **Instruments and protocols suggested** T. Salameh

11:45-12:00 **Discussion** Chaired by T. Petäjä

MEASUREMENTS OF NH₃

12:00-12:10 **Instruments and protocols suggested** S. Crunaire

12:10-12:20 **Discussion** Chaired by X. Querol

NEXT STEPS AND END OF THE MEETING

12:20-12:30 X. Querol and T, Petäjä

7.6 Agenda of Webinar on Implementing Revised EU Ambient Air Quality Directive



Part A | Oct. 4, 2024, 10:00-13:00 EEST (or 09:00 - 12:00 CEST)

Webinar on UFP and PNSD

- 10:00 - 10:10 Context of the webinar & introduction of speakers (*Eleni Athanastopoulou / John Wenger*)
- 10:10 - 10:20 Introduction from **ATMO-ACCESS** (*Sabine Philippin/Paolo Laj Project coordination*)
- 10:20 - 10:30 Introduction to the **RI-URBANS/ACTRIS** service tools (*Xavier Querol, IDAEA-CSIC / Tuukka Petaja, UHEL*)
- 10:30 - 11:15 **UFP** guidance and monitoring (*Andres Alastuey, Research Professor, IDAEA-CSIC*)
- 11:15 - 12:00 **PNSD** guidance and monitoring (*Ondracek Jakub, Senior Scientist, ICPF*)
- 12:00 - 12:30 Added value of measuring **UFP** and **PNSD** (*Xavier Querol, Research Professor, IDAEA-CSIC*)
- 12:30 - 13:00 Final questions and Closing remarks

Part B | Oct. 22, 2024, 14:00-17:00 EEST (or 13:00 - 16:00 CEST)

Webinar on VOCs, PM speciation and BC

- 14:00 - 14:15 Introduction (*ATMO-ACCESS*)
- 14:15 - 15:00 **VOCs** guidance, monitoring, added value (*Therese Salameh, Senior researcher, IMT*)
- 15:00 - 15:45 Guidance and monitoring for Online/ Offline **PM** Speciation - added value (*Jean-Eudes Petit, Researcher at LSCE*)
- 15:45 - 16:30 **BC** guidance, monitoring, added value (*Marco Pandolfi, Researcher, IDAEA-CSIC*)
- 16:30 - 17:00 Feedback from the audience and Conclusions