Report of the 3rd meeting of the Expert Panel on Clean Air in Cities (EPCAC) held online on Nov. 29, 2021

Key messages

New WHO global air quality guidelines are published in 2021, including guideline levels (with interim targets) for $PM_{2.5}$, PM_{10}, O_3, NO_2, SO_2 and CO and good practice statements for some type of PM. Several of the new air quality guidelines levels are lower than the previous levels and also lower than the EU air quality limit values. These new guidelines emphasize that air pollution is still a leading cause of health damage in Europe and around the world. Although air quality in Europe has improved since the 1980s and the EU air quality limit values are met in many countries, meeting the new WHO guideline levels requires large additional reductions in emissions of most air pollutants.

The COVID19 lockdown in many countries proved that a reduction in traffic has significant positive effect on NO_2 air quality. Sustained reductions in emissions at least as large as during the lockdown would be needed to meet the WHO guideline levels for NO_2.

A range of different source sectors contribute to air pollution, such as traffic, industry, residential heating, and agriculture. These sectors contribute differently to the air pollution in cities. Local urban sources from traffic and residential heating contribute most to the (local peaks in) NO_2 air pollution in large cities, while sources from outside the city contribute most to (background levels of) PM_{10} and $PM_{2.5}$ air pollution in cities.

Atmospheric models are improving taking into account chemical and meteorological processes from street to European level. These models are used to quantify the contributions from the different sectors to the air pollution in a large number of cities in Europe. This provides the necessary information for local and national authorities for decisions related to air quality in combination with other policies, such as spatial planning, energy, and climate policies.

Positive actions to improve the air quality have been demonstrated for several cities. These can serve as examples for other cities and regions. It was demonstrated that attention for communication and raising awareness of the local air quality is important. There are several initiatives in cities to engage citizens. With 'citizen science' citizens contribute to measuring local air quality and get more engaged in decisions related to their local environment.

1. Around 95 participants from national governments, cities, the scientific community, NGO's and industry, the World Health Organization, and the European Commission participated in a workshop that was held online on Nov. 29, 2021. Roald Wolters (Netherlands) and Guus Velders (Netherlands) chaired the meeting.
2. Roman Perez Velasco from the World Health Organization (WHO) presented the new WHO global air quality guidelines which are published in 2021, including guideline levels for $PM_{2.5}$, PM_{10}, O_3, NO_2, SO_2 and CO Several of the new air quality guideline levels are lower than the previous levels and also lower than the EU air quality limit values. WHO

also defined interim targets for these compounds emphasizing that any improvement in air quality reduces the health impacts of air pollution.

3. The new WHO guidelines emphasize that air pollution is still a leading cause of health damage in Europe and around the world. Although air quality in Europe has improved since the 1980s and the EU air quality limit values are met in many countries, meeting the new WHO guideline levels requires large additional reductions in emissions of most air pollutants.
4. WHO also presented good practice statements for reducing exposure to black carbon/elementary carbon, ultra fine particles (UFP), and particles originating from sand and dust storms. For these types of PM the monitoring and management systems need to be expanded.
5. Michael Klinkenberg and Johanna Lindner (European Commission) presented the ongoing process of the revision of the EU's Ambient Air Quality Directives, for which the new WHO guidelines are a key source of input. The EC had conducted a fitness check of the current Ambient Air Quality Directives and identified shortcomings related to:
    a. Health outcomes: EU limit values are not fully aligned with scientific advice
    b. Enforcement: Exceedances are not always addressed sufficiently and/or on time
    c. Governance: Air quality plans do not always address all sources effectively
    d. Assessment/Monitoring: Flexibilities may sometimes impact the comparability of data
    e. Information: Public feels under-informed about poor air quality and its impacts

    The Commission plans to propose a revision of ambient air quality legislation in the second half of 2022. The EC also announced that the European Air Quality Index is now available as an app.
6. Several research groups presented results from modelling studies. Atmospheric models are improving taking into account chemical and meteorological processes from street to European level. These models are used to quantify the contributions from the different sectors to the air pollution in cities in Europe. This provides the necessary information for local and national authorities to choose priority sectors, identify important transboundary sources and analyze how air quality management can be aligned with other policies, such as spatial planning, energy, and climate policies.
7. The modelling studies show that a range of different source sectors contribute to air pollution, such as traffic, industry, residential heating, and agriculture. These sectors contribute differently to the air pollution in cities. Local urban sources from traffic and residential heating contribute most to the local peak NO_2 air pollution in large cities, while sources from outside the city contribute most to background PM_{10} and $PM_{2.5}$ air pollution in cities.
8. Bruce Rolstad Denby (EMEP/MSC-W) presented results of recent applications of their uEMEP fine scale model for Europe. This model used the EMEP/MSC-W model for the large-scale background and a Gaussian dispersion model to downscale concentrations to city level at 100 m resolution. The uEMEP model provides information of the source contributions for cities in Europe. For Norway air quality information of the cities is presented on websites.
9. Philippe Thunis (JRC) pointed to the new 2021 'Urban $PM_{2.5}$ atlas' with contributions of local, national and European emissions to concentrations in many European cities. For larger cities, local actions are responsible for a significant fraction of the local $PM_{2.5}$ air pollution. Abating agricultural emissions was identified as an effective way to improve

urban air quality. JRC also discussed that sometimes/often methodological choices can underestimate the city's responsibility for their air quality.

10. Ranjeet Sokhi (Univ. Hertfordshire, UK) presented high resolution modelling for London at 25, 5 and 1 km horizontal resolution. A 5 km resolution was shown to be sufficient for secondary components ($PM_{2.5}$ and O_3) for rural and urban background locations. For NO_2 concentrations a higher resolution is needed.
11. Christian Nagl (Umweltbundesamt – Environment Agency Austria /Vienna, Austria) presented different methods to estimate exposure to NO_2 in Austria in general and four cities in particular. He showed the importance of different assumptions, quality of input data and simplifications. High-resolution modelling in the cities took the height (number of floors) of buildings where people are living in to account. He stressed the importance of the quality and consistency of the data (emissions, population data, building shape, etc.), and the need for harmonized approaches for exposure estimates in Europe.
12. Positive actions to improve the air quality have been demonstrated for several cities. These can serve as examples for other cities and regions. It was demonstrated that attention for communication and raising awareness of the local air quality is important. These are several initiatives in cities to engage citizens.
13. Karin Blaauw (Netherlands ministry of infrastructure and water management) presented the clean air agreement in the Netherlands. The agreement focusses on reducing the health effects of air pollution and is a voluntary collaborative agreement between cities, regions, provinces and national government to improve air quality. During the process the public and businesses are involved. Integrated policy road maps include climate/energy measures, biodiversity protection and healthy mobility. Involving citizens (including citizen science) is a process of learning by doing.
14. Joanna Struzewska (Warsaw Univ of Technology) showed the joint effectiveness of local and regional air quality plans in Poland for 2022 and 2026. The actions planned are expected to significantly reduce PM and BaP concentrations in southern Poland. Changes in NO_2 are expected to be small because reductions in traffic emissions accompanied by increases in emissions from the residential sector.
15. Daniel Mehlig (Imperial College, UK) studied the effects of electrification of road transport on the air quality in the UK. Electrification gives small (and uncertain) benefits for $PM_{2.5}$ and air quality. The reductions in the exhaust emissions may be accompanied by small (but uncertain) increases in emissions from tyre and road wear. Reductions in car traffic are required to give more substantial improvements.
16. Beatriz Cardenas (WRI) presented work done in cities in Mexico. Tools have been developed for air quality forecast using machine learning techniques. Integrating climate and air quality policies offers dual benefits for cities in the global South.
17. Eliot Treharne (City of London) discussed the effects of the ultra low emission zones in London. He showed that significant reduction in NO_2 are observed from ULEZ in the inner city of London, on the same order of magnitude as the COVID lockdown. No real changes in PM concentrations are observed. Communication to the public of the air quality has been done at various levels in London.
18. Levente Molnar (EEA) presented case studies on air quality measures in Madrid, Berlin, and smog resolutions in Poland's Malopolska region. Each city has it own challenges to improve air quality.
19. There have been many studies on the effects of the COVID19 lockdown in 2020/2021 on the air quality in cities and rural areas. The COVID19 lockdown proved that a reduction

of traffic has significant positive effect on air quality. What lessons can be learned from this for improving air quality on the long run?

20. Ilaria D'Elia/Massimi D'Isidoro (ENEA, Italy), Lara Aleluia Reis (RFF-CMMC, Italy), and Alexandra Monteiro (Univ. of Aveiro) showed the results of the COVID lockdown on the air quality in Italy and Portugal. A consistent picture emerges from observations and modelling studies, which is confirmed by other studies. The lockdown resulted in significant decreases in NO_2 concentrations in cities and other areas resulting from the large reductions is traffic volumes. In response to the decrease in NO_2 small increases are observed in ozone concentrations. The effect of the lockdown on PM concentrations is smaller than on NO_2 because PM has many different sources, and also sources of which the emissions are not significantly effected by the lockdown, such as agriculture.