UFP-Integrating action for cleaner air and climate protection

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UfP Symposium 7

Brussels, 15-16 May 2019

Overview

- EFCA – Identity, Mission, Activities
- EFCA Strategy: “One Atmosphere”
- Current EFCA position on particulate matter, black carbon and UfP
- Developing a policy for UfP
- Characteristics of UfP as a target for action
- Elements of a policy for UfP
- Regimes and mechanisms
- Conclusions

Identity: what is EFCA?

European Federation of Clean Air Associations (15 members from 13 countries):

a European association of civil society bodies working by voluntary agreement on environmental issues

Mission

To help to achieve policies and measures that will protect the environment, climate and human health in Europe against the effects of pollution while fostering sustainable development

Principals

EFCA is committed to

- an evidence-based approach to development of policies, measures and their implementation
- promotion of a "one-atmosphere" approach to the framing of air/climate protection policies
- working with other civil society bodies and public institutions to improve understanding of air pollution and its consequences

Activities

- Conferences, organised by members (e.g. WCAC (Istanbul), Air Protect, Bol, Croatia, October 2019, host to the 2019 EFCA Assembly)
- Symposia (e.g. Ultra-fine Particles series: UfP-7, Brussels, 2019)
- Policy initiatives: P1 to P4
- Forum discussions
- Newsletter (No 30, April 2019) website (www.efca.net)
- Furthering professional activity
- Mutual assistance between Members, e.g. Study tour by CAPPA (Croatia) to Poland, June 2018

Policy Initiatives

1. **Improving the effectiveness of CAFE.** December 2004. Recommended approaches, in addition to the system of air quality limit values to improve health protection in Europe.

2. **Linking air pollution and climate change - a challenge for European legislation**. 2010. Showed inconsistencies between air quality and climate change legislation in the EU. Recommended improvements for Directives.

3. **Black Carbon Particles (BCP): Opportunities to strengthen policies on Air Quality and Climate Change in Europe**". Proposal to include Black Carbon Particles as an additional indicator for the protection of human health. Connects this with the need to reduce the emissions of Black Carbon to reduce global warming.

Particulate matter/black carbon/UFP – a one atmosphere issue

Current EFCA Activities

Symposium series on UFP (2007, 2009, 2011, 2013, 2015, 2017, ***2019***)

- ***Metrics session*** at UFP-3 (2011); proposal from the scientific community for Black Carbon Particles as additional metric, next to PM_{10}/$PM_{2.5}$
- ***Forum discussion*** at www.efca.net (2011/2012): what about Particle Numbers?
- ***Policy Initiative*** on Black Carbon Particles (PI-3, 2012) - ongoing work with the EU and the Air Convention (possible new ceiling with the GP revised)
- ***UFP-6***, Brussels 10-11 May 2017, https://www.imk-aaf.kit.edu/ufp/
- ***UFP-7***, Brussels May 2019

Evidence from UFP Symposia 1-6

- UFP especially from vehicle exhaust are associated with cardiovascular morbidity and mortality by multiple mechanisms
- cognitive decline may be associated with UFP pollution, but more evidence needed
- UFP has significant climate impact, new particle formation generates half of the cloud condensation nuclei in the atmosphere
- highly oxidized organic compounds from the biosphere have substantial influence on particle formation and growth
- Particles filters are considered a substantial success with significant positive health effects especially in abatement of Diesel engine emissions
- Some modern gasoline engines emit more particles than Diesel engines with filters
- aircraft and shipping significant sources with distinctive forms of UfP and specific toxicity profiles
- non-combustion sources, material from abrasion of road surfaces, brakes and lubricating oil also significant

Characteristics of UfP as a Policy Target

Wide range of sources and substances:

- Natural sources: sea spray, smoke
- Manufactured: process or end of life release of industrial and medical materials
- By-products: combustion particles, wear of machinery, food preparation
- Secondary pollutants: formed from photochemical reactions of primary emissions of SO_2 , ammonia, VOC

Characteristics of UfP as a Policy Target

UfP makes up little of the mass in convention measures of PM (PM_{10}, $PM_{2.5}$)

But has:

- high number density
- High active surface area

Characteristics of UfP as a Policy Target

Effects at all scales:

- Local scale, human health: evidence of multiple impacts, including on respiratory and cardiovascular systems and some evidence of UfP as factor in cognitive decline
- Regional scale, ecosystem impacts: ?evidence of damage to plants/microbial communities, reduced ecosystem function with consequences for ecosystem services
- Climate system: evidence of impacts on global warming through direct forcing (black carbon) role in cloud formation

Characteristics of UfP as a Policy Target

Health effects; Some sources/emissions seem particularly aggressive

- Vehicle exhausts
- Emissions from aircraft engines
- Shipping

Characteristics of UfP as a Policy Target

Health effects; indoor and ambient exposure:

- Transport (including in vehicle)
- Cooking
- Residential heating (particularly wood burning)

Characteristics of UfP as a Policy Target

Many sources already subject to emission controls

- Vehicle emissions; PM partly controlled
- Shipping emissions; controls coming into effect
- Secondary UfP; primary pollutants controlled

But many others are not

- Non-exhaust vehicle emissions
- Release of manufactured UfP in products at end of life
- Cooking
- Residential heating

Characteristics of UfP as a Policy Target

Some technologies have proved effective in reduction UfP emissions:

- Diesel Particulate Filters (DPFs), but maintenance/enforcement in service crucial
- Industrial particle emission control (bag houses/ESP)
- Low S fuels
- Replacing residential wood burning heaters

Elements of a policy for UfP

Tackle major sources:

- Transport emissions (mainly diesel exhaust)
- Residential wood burning
- Fuel sulphur content (including aviation fuels)

Elements of a policy for UfP

Make current controls work in service:

- DPFs; measures to reduce tampering, check for maintenance
- Industrial emissions of regulated pollutants (precursors); strict enforcement of, eg, IED
- Address side-effects; enforce regulation of ammonia slip (SCR/SNCR, vehicle Nox control)
- Revise statutory guidance for emission management

Elements of a policy for UfP

Extend controls where technology exists:

- DPF retrofit for construction machinery
- Shipping emission controls (PM and S)
- Subsidised replacement of wood burning heaters
- Dust control measures enforced on LCP
- Reduce regulated S content of aviation fuels
- Continued pressure on precursors of secondary UfP

Elements of a policy for UfP

Take opportunities for exposure reduction in physical planning and building control

- Requirements for ventilation in food preparation/cooking areas
- Thermal insulation to reduce heat demand
- Timetable for reduction and elimination of solid fuels for residential heating (and then elimination of gas heating)
- Planning for separation of pedestrian/cycling from vehicular traffic

Elements of a policy for UfP

Research agenda to address key knowledge gaps

- Aviation, a major growth sector, needs study
- Metrics, linked to monitoring, association with effects
- Setting credible standards/targets (emissions, ambient?)
- Ecosystem impacts (engineered UfP)
- Indoor environments, relative risk and reduction options
- Non-combustion traffic emissions (tyres/lubricants)

Regimes and Mechanisms

EU; European Air Protection Strategies and Measures:

- Source control directives: vehicles; L/M/S/CP; fuels directives (S, biomass)
- AQ Directives (Ambient, total exposure?)
- Linkage to product regulation (EcoDesign, thermal performance of buildings)

Regimes and Mechanisms

Regional (UNECE)

- Long-term strategy for CLRTAP; PM and precursors
- EB work plan; review/amendments of protocols
- WG Effects; Investigate relevance of action on short lived climate forcers to human and ecosystem health

Regimes and Mechanisms

Global; Climate and Clean Air Coalition

- Action on SLCPs
- Sector initiatives; brick kilns, HGVs
- Global health impacts assessments

Conclusions

- UfP recognised as a significant health risk factor
- Evidence demands policy response
- Areas where action can be taken now
  - Strengthening current measures
  - Adapting current policy instruments
- Future development built on evidence
  - Assessment of current research
  - Policy oriented future research
  - Effectiveness of measures
- Efficiency requires one atmosphere approach

Thank you for listening to EFCA

We welcome your questions and comments

www.efca.net

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End of Presentation

Auxiliary material follows:

- EFCA Strategy
- Black carbon slides
- Residential heating
- Flyer for Lille

EFCA Strategy 2017-2021

>EFCA's overarching theme is "One atmosphere", endorsed by EU Commissioner Janez Potočnik, in 2013, integrating climate and clean air policies and harvesting the related co-benefits

>EFCA endorses the EU Clean Air Package and revision of related EU Directives and is looking forward on the revision of the GP

>LCP, MCP and *Small Combustion Installations*

>EFCA is looking beyond Europe: EECCA

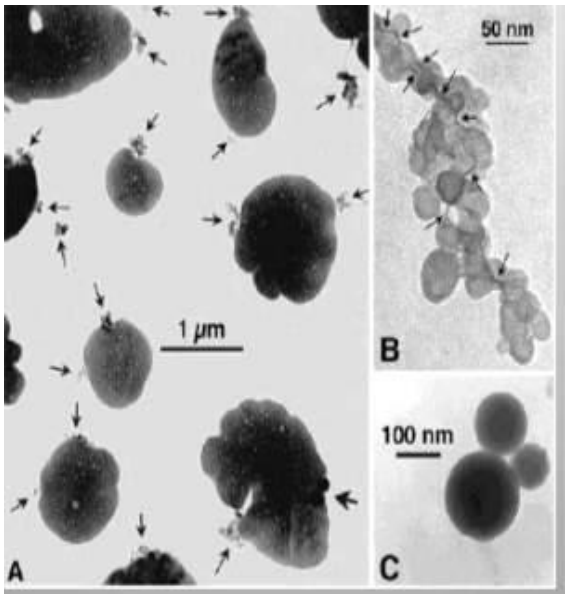
>EFCA welcomes EU clean energy initiatives, including the Winter Package of 2016 and ongoing revision of energy efficiency directives in heating, cooling, buildings and products

>***One message that should be hammered home is:***

„energy efficiency is the one energy resource all countries possess" (IEA)

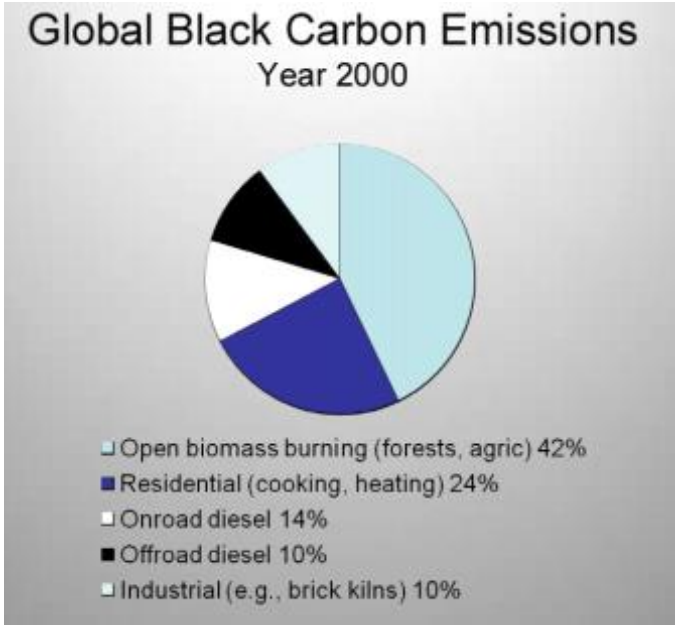
BLACK CARBON and UFP go together ?

- Combustion of all kinds produces pollution:
  - solid, including carbonaceous particles, sulphates and nitrates
  - gaseous, including SO_2, NO_x, CO_2, CO,
- Black carbon (BC) is the carbonaceous fraction of the particulate emission from combustion
- Particles of BC are typically small-UFP (less that 1 µm in diameter, known at $PM_{1.0}$) and come in many forms:
  - Charcoal, Tar and Soot
- All have the key property of absorbing energy from solar radiation
- **Note: EFCA UFP 2013** – Presence of high quantities of non-combustion components in UFP- tyre, road surface



Credit: Mihály Pósfai, Arizona State University

WHERE DOES BLACK CARBON COME FROM?



fires from burning biomass (agriculture, forest clearance)

Industry (incomplete combustion of fossil fuels)

Residential: heating and cooking

Diesel IC engines (transport and non-road) contribute nearly 25%

Non-road about 40% of diesel BC emission

Note EFCA UFP 2013: marine sources emerging as important new factor

BLACK CARBON REDUCTION TECHNOLOGY

For developed countries control of diesel BC would have significant effect

Current focus: diesel vehicles

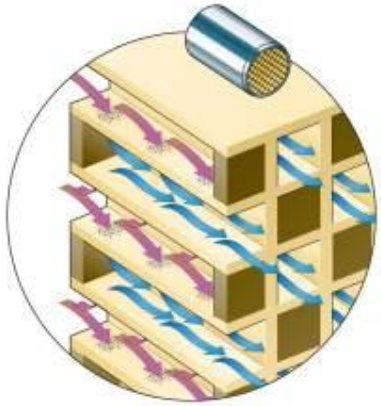
Diesel Particulate Filters (DPFs) reduce BC in diesel exhaust by 99%

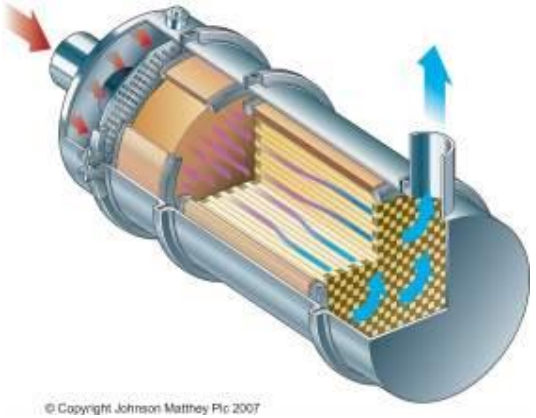
Currently widely fitted to new passenger cars, HGVs and Buses

BUT further opportunities

Retrofit to diesel in current road transpo fleets

Construction and other non-road vehicle and machinery





Residential heating or SCIs of less than 100 Kw

- 1990/2030 1 ml/0,5 ml tons (from 50% fossil to 20 %)
- Residential heating up to 40 % of daily means of PM
- Europe has the highest proportion of outdoor PM2,5 from household (21 % in Central Europe, PL up to 70 % -50 % from coal and 20 % from wood)
- Up to 50 % of BC in 2015 in the UNECE region with growing trend till 2050 (Ecodesign Directive is crucial, but more general guidance is needed)
- BC contributes to climate warming with high direct radiative forcing; together with organic carbon emissions, when deposited on snow and ice, it also reduces albedo, with consequent warming
- Improving the efficiency of combustion acts to reduce mainly BC, PAH and B(a)P
- Important measures: plant choice, replacement of old stoves, fuel choice; fuel loading, firing, combustion, maintenance and awarness raising of citizens to foster behavioural changes
- Possible measures: administrative bans (Ireland, Lombardy-Italy, Cracow-Poland)
- UNECE/TEFTEI is preparinfg the Guidance on SCIs (Co-chair Mr. Tizianio Pignatelli from ENEA)

Black carbon reduction: residential heating

Options:

- Phase out old stoves
- Replace with ecostandard
- Improve fuel quality
- Dry wood
- Low emission coal
- Replace solid fuel with gas
- District heating with gas

Potential New EFCA policy initiatives based on UFP-6th>new metric on UFP expressed by weight and number (P4)

- UFP especially from vehicle exhaust is associated with cardiovascular morbidity and mortality by multiple mechanisms
- cognitive decline may be associated with UFP pollution, evidence is growing (see, e.g. Hong King study 2018)
- UFP has significant climate impact, new particle formation generates half of the cloud condensation nuclei in the atmosphere
- highly oxidized organic compounds from the biosphere have substantial influence on particle formation and growth
- Particles filters are considered a substantial success with significant positive health effects especially in abatement of Diesel engine emissions
- Some modern gasoline engines emit more particles than Diesel engines with filters
- aircraft and shipping significant sources with distinctive forms of UfP and specific toxicity profiles
- non-combustion sources, material from abrasion of road surfaces, brakes and lubricating oil also significant
- Secondary and non-combustion sources a challenge for policy development.
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To work together on P4 and to get citizens support

Conclusions

- EFCA policy initiatives driven by evidence of effects
- EFCA committed to "one-atmosphere", including related co-benefits and to cost effective policy solutions
- Full support to direct regulation of black carbon as suggested in Policy Initiative 3
- DPFs have proved a highly effective control measure for BC
- More controls on SCIs and non-combustion sources needed
- EFCA UFP Symposia have provided evidence of impacts, sources and on effective control techniques
- EFCA is ready for PI4, on UFP standards (size and number)
- Further action should include shipping and non-combustion sources
- PI4 will be challenging for policy makers

Thank you for listening to EFCA

Grazie per l'attentione

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