EFCA Newsletter

European Federation of Clean Air and Environmental Protection Associations

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In this Issue

New challenges

With the Year of Air behind us, the Commission is to await the opinion of the European Parliament on its legislative proposals for the NEC Directive and the connected ratification of the amended Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution. The substance of both proposals are agreed national ceilings values and, as they were negotiated before the Executive Body of the Convention decided on the amendments they should not be controversial. The Rapporteurs for both proposals have been nominated by the European Parliament Committee for environment. However, the elections for a new Parliament are likely to cause an interruption in the Committee's work and the conclusion of Parliament's procedure on the proposals can be expected only in the second half of the year.

The Commission, however, now has to detail its approach to the new policies outlined in the revised Thematic Strategy on Air Pollution. With this in mind EFCA has reviewed the state of play with respect to the most pressing problem, particulate matter. The EFCA review is summarised in an article in this issue.

This year, new climate policy is likely to generate long and intensive discussions. In the following pages there is a summary of the proposal for the Energy and Climate Policy for 2030. The implementation of this new policy will be completely dependent on the EU's energy policy, which has its own objectives. The sensitive proposals are *Chefsache*: president Barroso joined Commissioners Oettinger and Hedegaard in the presentation. The proposal will serve to mark the position of the European Union in the negotiations on a successor of the Kyoto Protocol. The new Protocol, which is to be agreed upon in Paris in 2015, should bind the parties to the UN Framework Convention on Climate Change to CO_2-emission reductions of sufficient ambition to halt the rise of atmospheric CO_2-levels and keep global warming within acceptable limits to prevent more serious damage. For Europe, one key aspect is the proper functioning of the Emissions Trading System. This is a significant challenge but a proposal for a 'market stability reserve' is aimed at improving it.

Developments in EU policy

Energy and Climate Policy for 2030

On 22 January the Commission published a proposal for a reduction in greenhouse gas emissions of 40% below to the 1990 level in 2030 and accompanying commitments and related governance. It includes the following elements:

1. **Reduction target**. The 40% reduction is meant as the pledge which is the EU wants to make in the negotiations for a successor of the Kyoto Protocol, to be agreed in Paris in 2015. The 40% reduction is to be made through domestic measures only: international credits will not be allowed after 2020. The annual emissions cap of 1.74% presently is to be increased to 2.2% after 2020. Emissions from sectors outside the EU ETS would then need to be cut by 30% below the 2005 level.
2. **Renewable energy and energy efficiency** together should produce the reduction. For the EU as a whole the target for renewable energy is at least 27%. Member States are free to decide whether they want to meet their overall reduction target primarily by renewable energy or by increasing their energy efficiency. The renewable energy target for the EU is also meant as a driver for continued investment in that sector and so stimulate innovation. There is no target for energy efficiency.
3. **Environmental Trading System**. The Commission proposes to establish a 'market stability reserve' at the beginning of the next ETS trading period in 2021. The reserve is meant to address the surplus of emission allowances that has been build up in recent years and improve the systems resilience to major shocks by automatically adjusting the supply of allowances to be auctioned. Under the proposed legislation the reserve would operate entirely according to predefined rules which would leave no discretion to the Commission or Member States in its implementation.
4. **Competitive, affordable and secure energy**. A set of indicators is proposed which could provide a factual basis for potential policy response. Reasons for that could include interconnection capacity between Member States, as well as external factors, such as energy price differences with major trading partners.
5. **A new governance framework** based on national plans for competitive, secure and sustainable energy. The Commission will provide guidance for a common approach to the national plans which should aim to stronger investor certainty and greater transparency, in order to enhance coherence, EU coordination and surveillance. The governance framework primarily aims to keep the EU competitive in comparison with their most important trade partners, in particular the US with its low gas prices, as explained in an accompanying *Report on energy prices and costs*.

More information on Energy aspects: http://ec.europa.eu/energy/2030_en.htm ; on Climate aspects: http://ec.europa.eu/clima/policies/2030/index_en.htm

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EU and Africa join forces on Climate Change

At a ministerial climate seminar on 2 April 2014 high representatives of the two continents, including Climate Action Commissioner Connie Hedegaard, issued a joint Statement with respect to the risks of climate change and the political response which is required to avert more serious future damage. The Statement preludes in particular to the climate negotiations in this and next year for a new agreement under the UN Framework Convention on Climate Change. In

this respect the two Unions agreed "to do what is within their power to convince other partners of the need for a fair, balanced, equitable and ambitious legally binding agreement to be adopted by the end of 2015".
More information: http://europa.eu/rapid/press-release_STATEMENT-14-97_en.htm

Emissions from cars

On 25 February 2014 the European Parliament voted in favour of a proposal to limit the CO_2-emission from cars to 90 g CO_2/km from 2021. The decision was preceded by long and tough negotiations at the highest level, because of the fear that the German automobile industry might not be able to meet the new target. In general, there is consensus that the target is within reach on the basis of the existing technologies. In comparison, the emission of cars dropped from an average of 159 to 132 g CO_2/km between 2007 and 2012 and already nearly meets the present target of 130 g CO_2/km for 2015. The industry is allowed to compensate for the high emitting models by producing low-emitting cars.
More information:
http://ec.europa.eu/clima/news/articles/news_2014022501_en/htm

Mobile air conditioning systems

The EU has specific regulation on allowed refrigerants in mobile systems for air conditioning (MAC Directive, 2006/40/EC). Through the years refrigerants have been several fluorinated gases with relatively high Global Warming Potentials. Since 2011 refrigerants must have a GWP of 150 or below when compared to CO_2. As such the refrigerant R134a with a GWP of 1300 had to phased out by 1 January 2011; the refrigerant HFO 1234yf was selected by the industry as substitute.
Attempts by a German producer, which seemed to be backed by the German authorities, to receive an extension to the right to use R134a have resulted on 23 January this year in a 'Pilot' for a formal infringement procedure against the German authorities, requesting to ensure that the Directive is fully applied by the respective producer. Germany has two months for a reaction before the procedure will be started. It also had to send Pilot letters with a request for more information to three more countries, the United Kingdom, Belgium and Luxembourg, which informed the Commission of possible similar practices by their national type-approval authority.
More information:
http://ec.europa.eu/enterprise/sectors/automotive/environment/macs/index_en.htm

Plea for economic fiscal reform

In a Press release on 25 March 2014 the *European Economic and Social Committee* sent a message to the European policymakers to send strong and clear signals to markets if they want to move towards a low-carbon economy.
Their opinion on own initiative highlighted the need to speed up the process and pleaded for a more rigorous application of the "polluter pays principle". This means revealing the true cost of production and consumption and rewarding resource efficiency and sustainable behaviour. Swifter progress can be achieved through a combination of a clear, efficient regulatory framework and market-based instruments, such as environmental taxes. The road towards such a policy means an environmental fiscal reform, moving away from taxation on labour and towards resource use.
More information:
http://www.eesc.europa.eu/?i=portal.en.nat-opinions.30549

EEA Reports

Air pollution by ozone across Europe during summer 2013
An analysis of ozone monitoring data in 2013 pointed out that in Mediterranean and alpine regions a considerable part of the population is being exposed to ozone at levels which exceed limit values. The Long Term Objective (120µg/m^3) was exceeded at 83% of all monitoring stations and during more than 25 days in a significant part of Europe. For more results:

EEA Technical report No 3/2014, 13 March 2014; http://www.eea.europa.eu/publications/air-pollution-by-ozone-across-1

Very high air pollution levels across Western Europe

During a five-day episode in March France, Belgium and parts of Germany suffered from high levels of PM_{10} above the daily mean limit of 50µg/m$^{3;}$ at some stations twice that amount was measured. The exceptional situation forced authorities to take urgent measures: in the Paris region free public transport was offered, in order to reduce the use of private cars. More information at: http://www.eea.europa.eu/highlights/.

Eleven countries exceed emissions ceilings

2010 was the year that EU Member States had ultimately to meet the emissions ceilings levels for SO_2, NO_x, NH_3 and VOC as specified in the NEC Directive (2005). Preliminary results of the emissions analysis (to be published in June this year) indicate that 11 countries still exceed the limits for at least one component. NO_x-emissions provide most difficulties, while all 27 Member States have managed to meet their target for SO_2.

More information at http://www.eea.europa.eu/highlights/

Clean Sky program

Clean Sky is an ambitious aeronautical research programme in Europe with participation of all major parties in the aviation branch in Europe. Its mission is to develop breakthrough technologies to significantly increase the environmental performances of airplanes and air transport, resulting in less noisy and more fuel efficient aircraft, hence bringing a key contribution in achieving the Single European Sky environmental objectives.

The Clean Sky JTI (Joint Technology Initiative) was born in 2008 and represents a unique Public-Private Partnership between the European Commission and the industry. It is managed by the Clean Sky Joint Undertaking (CSJU) until 31 December 2017.

The CSJU will deliver demonstrators in all segments of civil air transport, grouped into six technological areas called 'Integrated Technology Demonstrators' (ITD).

Clean Sky JTI was born in 2008 with a budget of € 1.6 billion, contributed to on a 50/50 basis by the Commission (in cash) and the aeronautical industry (in-kind contribution). ITD Leaders commit up to 50%, Associates members up to 25% and Partners (through Call for Proposals) a minimum of 25%. The open program counts 10 Leaders, 65 Associates and 473 Partners across Europe. More information, including details on its Achievements so far can be found at its website www.cleansky.eu.

Controlling the Risks of Particulate Matter
State of Play

Until the middle of last century air pollution was generally represented by the levels of sulphur dioxide and a combination of Total Suspended Particulates (TSP) and Black Smoke (BS) for particles as indicators. From the forties the picture became gradually more detailed for gaseous pollutants: Haagen-Smit identified ozone as ingredient of 'Los Angeles smog' and gaseous air pollution evolved towards the present set of regulated components which we find, e.g., in European legislation and which is based on the specific health risks of each pollutant.

Until the present day such detail has not been made available for particulate matter to the same extent. In the past TSP and BS data served to support source-oriented measures; the low accuracies of the sampling and measuring methods rendered them less helpful in monitoring studies.

This changed in the early seventies when the concept of the aerodynamic diameter for particles was introduced, in combination with sampling and measurement methods which enabled to selectively sample finer fractions and provide data with higher accuracy. The method was widely introduced in monitoring networks and since generated decades of time series of monitoring data which were suitable for long-term epidemiological studies and policy development. PM_{10} became accepted worldwide as indicator for pollution from particles for which meaningful relations for connected health risks could be developed. In the beginning of this century it was supplemented by $PM_{2.5}$ when concern on specific risks of finer fractions appeared to be justified.

The chemical composition of PM, however, predominantly remained a black box in policy development. The exception were the extensive efforts to assess levels of heavy metals in particulate matter samples. The resulting impressive database was helpful for the Heavy Metals Protocol of the CLRTAP and supported the development of source-oriented policy for industrial sources as presently laid down in the EU's Industrial Emissions Directive. Its success reduced the urgency for the development of specific air quality policies for heavy metals.

During the first decade of this century, however, the conviction increased that the present approach of regulating through inadequately defined metrics for particles has too many deficiencies. Discussions were also fuelled by the difficulties of most EU Member States to develop and implement policies which could result in compliance with the limit value for PM_{10}.The main objections include:

- Metrics like $PM_{10}/PM_{2.5}$ which cannot be directly related to specific sources or categories of sources make it difficult and sometimes impossible for EU Member States to comply with the respective limit values
- Indications that specific chemical fractions of PM are more toxic than the average of the mixture of all its components have become stronger and are throwing doubt on the effectiveness of present PM regulation for the protection of public health
- The present size-differentiation of PM ignores the strong indications that the ultrafine fractions have an additional size-specific toxicity
- Because $PM_{10}/PM_{2.5}$ metrics do not specify colour they are unsuitable in a 'One atmosphere' approach which integrates climate and clean air policies; by ignoring this in air quality legislation there is no stimulation to select options with the higher overall cost-effectiveness with respect to climate and clean air at national and de-central levels.

Fraction-by-fraction approach

In response to these deficiencies, EFCA recently pleaded for addressing particulate matter through a fraction-by-fraction approach[1]; this would facilitate the connection with sources and would enable policymakers to select options on their potential to protect public health, and on their overall cost-effectiveness considering climate objections.

Costs effectiveness aspects

The present state of knowledge does not allow to estimate the costs of a fraction-by fraction policy and compare these with those of the present $PM_{10}/PM_{2.5}$ policy. A recent report by Concawe [2], however, suggests that substantial differences are likely.

The Concawe study includes a number of sensitivity analyses with an Integrated Assessment Model based on the (different) costs of emission reductions of primary particles and of inorganic secondary particles (from precursors SO_2, NO_x and NH_3). These costs have been defined for the 'Maximum Technical Feasible Reduction' scenario, used in IIASA's GAINS-model.

If 50% of these costs result from measures that equally address primary and secondary particles total costs in the EU are estimated at €1.1 billion/year. Assuming that the $PM_{2.5}$ fraction contains primary particles only and that toxicity would be completely concentrated in the $PM_{2.5}$ fraction the costs of measures would sink to €0.4 billion/year. Though both assumptions are incorrect the claim of higher cost-effectiveness by more targeted approaches is credible.

Relevant fractions

Four fractions of particulate matter which are each associated with health impacts have by now emerged and qualify for being considered in a fraction-by-fraction approach. Three of them are chemically different: *Black Carbon (***BC***)* and the fractions of *Primary and Secondary Organic Aerosols,* **POA** *and* **SOA**, particles which have polycyclic aromatics (PCA) and their derivatives adsorbed at their surface. *Particle Numbers Concentration* (**PNC**), though chemically undefined, may serve as a proxy for the specific health risks of the ultrafine fraction of PM.

Obviously, this recommendation requires further discussion. Databases on the emissions and atmospheric concentrations of the four fractions are presently incomplete or even scarce which prevents that their long-term health effects can be investigated in epidemiological studies. The situation varies for each and information on this is summarised below.

Black Carbon

In 2011/2012 EFCA supported a proposal from the scientific community to regulate BC as an additional indicator of air quality, because of its higher impact on health in comparison to $PM_{2.5}$ and its contribution to global warming[4]. The proposal was discussed again in a special session of IUAPPA's 16th World Clean Air Congress in Capetown, South Africa[5]. The recommendation was to introduce BC as additional indicator in the Air Quality Directive. Though an estimate of the benefits of its emissions reduction in terms of reduced mortality cannot be provided presently, its status as a regulated pollutant would require its monitoring in the EU and so stimulate epidemiologists to derive dose-response relations for its various health endpoints. Such studies may not deliver within the next ten years; they are essential, however, in order to account more precisely for the effectiveness of PM policies.

Hong Kong covered by the Asian Brown Cloud in 2007. Studies by Ramanathan et al [3] have pointed out that the ABC is a net climate forcer, due to its high content of black carbon.

Particle Numbers

As alternative for a BC policy also the reduction of PNC has been advocated for several years. PNC specifically addresses the more numerous nano-size range of particles which is the fraction that, like gases, may enter the circulation upon inhalation. Like BC, PNC is connected to combustion-generated aerosols. Its database, however, is even less developed than for BC; in particular, its health effects have been poorly quantified.

More than two decades ago, however, the Swiss institutes AFHB and EMPA, under the umbrella of the VERT association[6], took a lead in the development, testing and certification of Diesel

Particle Filters (DPF). First applications were in retrofitting buses in Geneva and Zurich in 1992. From 1996 DPFs became mandatory for underground diesel machinery with PN in the range of 10-500 nm as criterion. In 2002 DPFs were required for all construction machinery, stationary sources, locomotives and ships[7a-d]. For road vehicles Switzerland followed the EU's Regulations; presently, the EURO VI Regulation on emissions from Heavy Vehicles[8] and the Euro 5/6 Regulation for Light Duty Vehicles[9] have been included in Swiss legislation.

The EURO VI requirement to reduce PNC emissions is also effective in reducing emissions of BCP. Performance of dpf's was gradually improved with respect to effectiveness and lifetime and extended to devices which, in addition, reduce emissions of gaseous pollutants.

Organic Carbon

Combustion processes which are the major sources of particles also produce semi-volatile polycyclic aromatics (PCAs), several of which are known to be carcinogenic. At the elevated temperatures of exhaust gases most PCAs are emitted as gases; at ambient temperatures, however, most of them condense and are deposited at surfaces of ubiquitous small particles in the atmosphere. Exposure to this Primary Organic Aerosol (POA) increases health risks of PM.

Novel findings in recent years have now confirmed that this POA is subject to photochemical conversion during the day through the type of reactions which also favour the formation of photochemical smog with its characteristic deepening of the smog in the second half of the day, referred to as 'aged smog'[10]. The development of the technique Time of Flight Mass Spectrometry[11] made it possible to confirm the different chemical character of the secondary organic aerosols (SOA) and to quantitatively assess the levels of POA and SOA in PM samples separately. The atmospheric processes have also been confirmed in simulation experiments with diluted exhaust gases in a smogchamber[12]. Though the above processes are most efficient in the summer season only, their impact requires serious attention.

In comparison to the POA fraction the resulting 'aged smog' appears to be more reactive in genotoxic tests and, in chemical assays, has the higher 'oxidative capacity'. This implies that its surface contains more 'reactive oxidative species' (ROS) which may be responsible for 'oxidative stress' in humans. Because particle sizes are primarily in the ultrafine fraction (<170 nm) they may enter the blood circulation upon inhalation and impact on crucial processes, causing inflammations and cardiovascular complaints.

Biofuels

In relation to the above it is of interest to note the existing concern with respect to the impacts of the use of biofuels on air quality. Recent Australian research[13, 14] revealed that biofuels produce much more reactive oxidative species in simulation experiments in comparison to fossil fuels and consequently may increase health risks. The key finding is that the oxygenated ingredients like ethanol in petrol and biodiesel are responsible. This is also observed in mixtures with fossil fuels which consist of hydrocarbons only.

Implications for policy development

From the analysis above it could be cautiously concluded that the fraction-by-fraction approach, in practice a dual approach for resp. BC/PNC and POA-SOA-PCA is needed. Of these BC/PNC requires straightforward emission reduction measures; for the SOA-fraction an approach along two lines could have the higher effectiveness.

- Policies which aim to specifically reduce emissions of the SOA-precursors, which means reducing emissions of PCAs
- Policies which reduce the atmospheric conversion of PCAs; this requires the same measures which are recommended for reducing tropospheric ozone levels, i.e. reduction of NO_x- and VOC-emissions in general.

The proposals of the European Commission

Fortunately, actual policies and their strengthening, according to the Commission's Year-of-Air-proposals[15], support both approaches. The recognition to consider the short-lived climate pollutants (SLCPs), black carbon, ozone and methane[15, 16], provides a framework for further new developments.

This is already visible in the proposal for the NEC Directive which includes emissions ceilings values for methane in 2030 and the intention to have

these for BC in a foreseeable future. The ceiling values for NO_x and VOC, with reductions between 2005 and 2030 of resp. 69% and 52% may reduce the formation of ozone and possibly SOA. In the meantime the stricter ceilings values for $PM_{2.5}$ support direct emissions reductions of PM.

Implications for future policies

The targets of the NEC Directive and the protection of public health will require strong source policies, in particular for combustion-generated emissions. New developments which will be needed include:

- With respect to road transport advanced DPF technology which, in addition to filtering ultrafine particles, targets the emissions of PCAs, is a powerful new development with considerable potential. It should be noted, however, that the latest Regulations for vehicles do not require their use in petrol driven passengers cars. As DPFs have been developed for diesel engines further cleaning of the petrol driven part of the car fleet will require specific systems.
- Use of biofuels, as explained above, presently increases the risks for public health; their use should be discouraged until EUROVI and Euro5/6 category vehicles dominate the car fleet and road tests have demonstrated that advanced DPF technology adequately reduces PCA emissions; until then their use would be rather confined to well regulated combustion installations.
- Wood combustion for heating private homes is a strong source of ultrafine particles and PCAs; its regulation will have to be considered.
- Aviation has markedly contributed to the rise in background tropospheric ozone levels since the middle of last century because of its emissions of NO_x, CO and organics in the upper troposphere of the Northern Hemisphere; new technologies will be required to address this problem.
- The balance between Best Available Technologies and their energy penalty requires more attention. When clean technologies target emissions of SLCP an energy penalty could be well acceptable.
- With respect to air quality in general further assessments of BC/PNC and PCA are needed to identify gaps in knowledge and capacities and in order to direct R&D programmes to supply these.

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EFCA activities in 2014

NCGG

VVM network of environmental professionals

7th International Symposium on Non-CO_2 Greenhouse Gases (NCGG7)

From 5-7 November 2014 VVM-CLAN will host its 7th symposium on Non-CO_2 Greenhouse Gases under the motto *"Innovations for a sustainable future"*. The venue is Amsterdam, Netherlands. Registration for participants is already open and details can be found at the conference website, www.ncgg.info. The Call for Papers is closed now.

EFCA session at NCGG-7

EFCA is sponsoring the symposium and agreed with the organizers to arrange a Special session in Amsterdam under the title:

"Aerosol fractions, climate forcing and air pollution"

The programming of the NCGG-series used to focus on progress in our understanding of the atmospheric budgets of methane, nitrous oxide and the F-gases, paying some attention to tropospheric ozone. When in the beginning of this century black carbon (BC) was identified as a strong climate forcer extension of the scope of the NCGG-series with BC seemed logical.

BC also has a long history in air pollution: as black smoke it has been addressed throughout the 20th century until the seventies when PM size fractions took its place as indicators for particulate matter. In that approach the chemical composition of particles is ignored, however. A more detailed approach is presently under discussion, also considering the fractions of secondary inorganic and organic aerosol.

With the session it is aimed to confront the different approaches at present uncertainties around atmospheric particles in the domains of

climate forcing and air pollution and, by doing so, deepen present insights.

A few more presentations could still be accepted. Experts who are interested to contribute are invited to contact the convener, Joop van Ham at info@efca.net. The deadline for proposals is 15 May 2014.

A **scope document** with relevant questions for the session and further background information can be downloaded from the EFCA website. The preliminary program for the session is available upon request for prospective contributors and can be found from 1 May as Annex to the scope document**.**

News from EFCA and its Members

Kommission Reinhaltung der Luft

Movie on Clean Air

EFCA's German Member, the Commission on Air Pollution Prevention VDI and DIN, informed us that they produced a new movie on air pollution and its abatement recently.

The Movie, which is German spoken, can be started by clicking the image and is available at: Youtube (http://youtu.be/igkdejqtyce).
A high-resolution version can be downloaded from: http://mats.vdi-online.de/download/download.php?4374-458496f22614.

Conference on Emission reduction
The „Kommission" also announced a two-day conference ***Emissionsminderung2014***, to be held in Nuremburg on 20 and 21 May 2014. The organizers refer to new challenges which result from the recent legislative proposal for the NEC Directive. Further information can be found at www.vdi.de/emissionsminderung.

Calendar

Delivering Multiple Benefits from Our Land: Sustainable Development in Practice
15-16 April 2014, Edinburgh, UK
(www.sruc.ac.uk/srucsepaconf)

International Conference and Exhibition on Emissions Monitoring
14-16 May 2014, Istanbul, Turkey (www.cem.uk.com)

Emissionsminderung (Emission reduction) 2014 - KRdL-conference
20-21 May 2014, Nürnberg, Germany
(www.vdi.de/emissionsminderung)

9th International Conference "Environmental Engineering"
22–23 May 2014, Vilnius, Lithuania
(http://enviro.vgtu.lt)

Circular economy – saving resources, creating jobs Green Week 2014
3-5 June 2014, Brussels
(http://ec.europa.eu/greenweek)

18th Conference on Combustion-generated Nanoparticles
25-27 June 2014, Zurich, Switzerland
(www.nanoparticles.ethz.ch) CfP: 11-04-2014

Indoor Air 2014 – 13th International Conference on Indoor Air Quality and Climate

7-12 July, Hong Kong, China.
(http://www.indoorair2014.org)

International Aerosol Conference
21 August-5 September 2014, Busan, South Korea.
(http://www.iac2014.net)

26th Annual International Society for Environmental Epidemiology (ISEE) Conference - From Local to Global: Advancing Science for Policy in Environmental Health
August 24-28th, 2014, Seattle, USA
(www.isee2014.org)

International Conference on Integrated Management of Environment
25-28 September 2014, Hammamet, Tunisia
(www.icime.net) CfP: 30-04-2014

7th Symposium on Non-CO_2 Greenhouse Gases - Innovation for a sustainable future (NCGG-7) 5-7 November 2014, Amsterdam, Netherlands
(www.ncgg.info)

5th International Conference on Plants & Environmental Pollution (ICPEP- 5)
3-6 December 2014, Lucknow, India
(http://isebindia.com)

Environmental Technology for Impact
19-20 April 2015, Wageningen, Netherlands,
http://etei/org CfP: 1-10-2014

17th IUAPPA World Clean Air Congress
25-30 September 2016, Bunan, South Korea
(www.iuappa.org)

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Newsletter

Editor Joop van Ham, VVM-CLAN

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European Federation of Clean Air and Environmental Protection Associations
Burg. Scholtenstraat 1, NL-2645 NL DELFGAUW
E-mail: info@efca.net
Fax: +31-15-261 3186
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