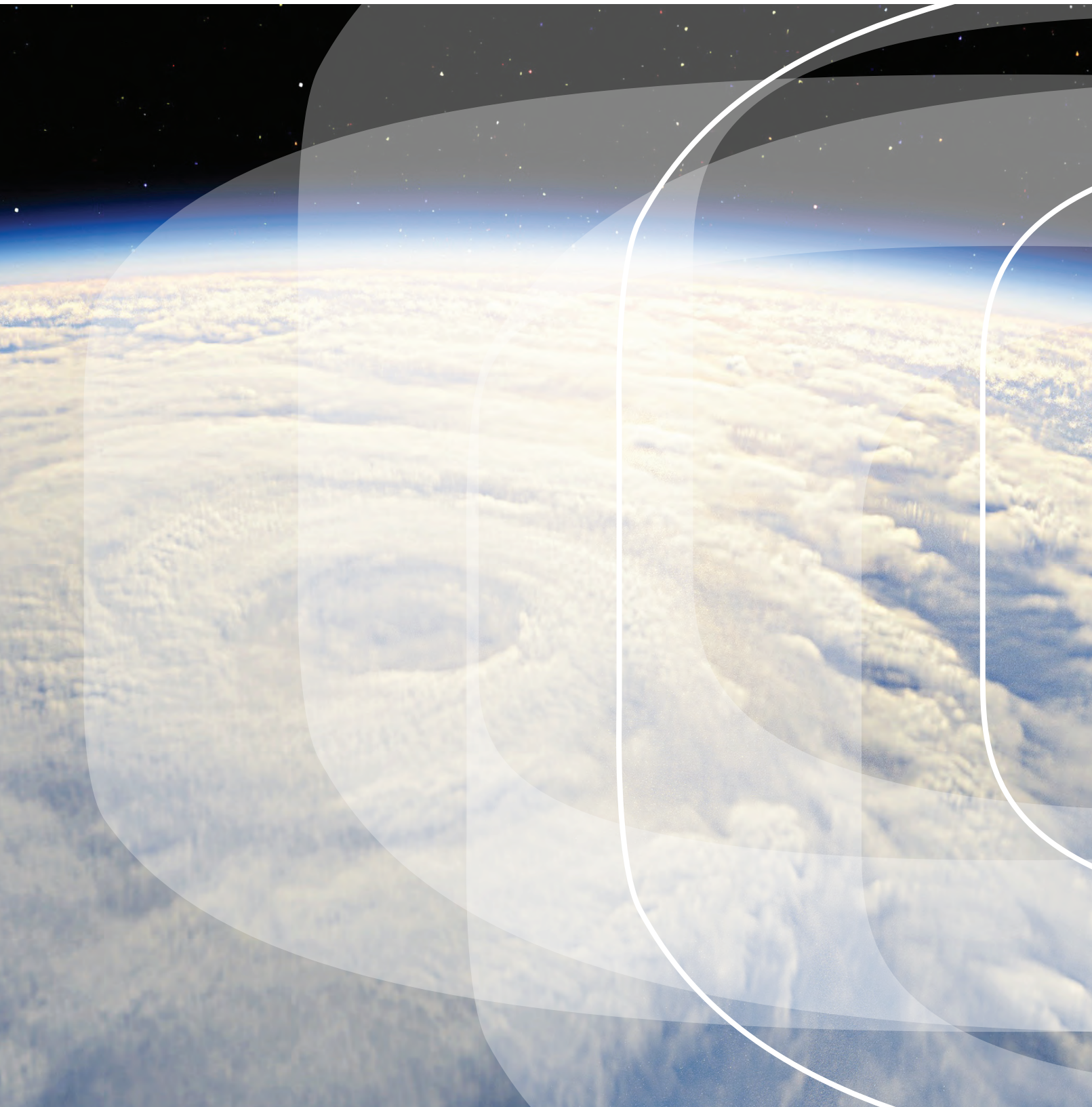
Saltsjöbaden V – Taking international air pollution policies into the future

Gothenburg 24–26 June 2013

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Content

Preface

This report contains a compilation of the outcomes of an international workshop on future air pollution strategies held in Gothenburg 24–26 June 2013. It is the fifth in a row of a series of workshops that are organised under the heading of "Saltsjöbaden workshops" of which the first one was held in Saltsjöbaden, Sweden in 2000. The workshops have been organised with the aim to discuss international air pollution issues, in particular those of transboundary nature and they have formed a basis for further work within international organisations, in particular the UN ECE Convention on Long-range Transboundary Air Pollution (CLRTAP) and the European Commission (EC). The workshops have attracted policymakers, scientists and experts within the field and formed an informal platform at which new ideas and concepts are able to be discussed without formal procedures.

This workshop was organised by the Swedish Environmental Protection agency and the IVL Swedish Environmental Research Institute in close colaboration with CLRTAP, EC, The Global Atmospheric Pollution Forum and the Nordic Council of Ministers. The workshop was attended by about 130 scientists, policymakers and experts within the field of air pollution, its effects and control.

A Program Committee (Annex A) was established for the overall planning of the workshop program, in particular for the selection of topics and for the final preparations of the general conclusions and recommendations.

This workshop, as the previous ones, was organised in a format with an introductory plenary session with presentations on the main topics of interest, followed by discussions in working groups leading to conclusions and recommendations. Finally the outcome was presented and discussed at a general plenary session, where a set of general conclusions and recommendations were agreed upon.

This report contains general conclusions and recommendations as well as the reports from each of the seven working groups at the meeting. The plenary presentations can be found at the web page of the meeting; http://www.saltsjobaden5.ivl.se/. The key to the abbreviations is given in Annex D in this report.

The workshop was supported by the Swedish Environmental Protection Agency, The Nordic Council of Ministers and the Mistra Foundation. We as organizers express our great thanks to the financial support that made the implementation of the "Saltsjöbaden V" possible. We also want to thank all those who contributed to the workshop, speakers, Working Group leaders, Program Committee, Rob Maas and Kimber Scavo, who significantly contributed to the final report, and not the least all participants.

Further information about the workshop can be found at http://www.saltsjobaden5.ivl.se, where also reports from previous workshops can be found.

Gothenburg and Stockholm, 17 September 2013

Peringe Grennfelt, Anna Engleryd, John Munthe and Ulrika Håård

1. Introduction

On 24–26 June 2013, more than 130 leading experts and scientists, policy makers and negotiators, international organisations and industry representatives met at an international workshop in Gothenburg, Sweden, in order to discuss and outline future directions in air pollution science and policy. The workshop was organised by the Swedish Environmental Protection Agency and the IVL Swedish Environmental Research Institute, in collaboration with international organisations such as the Convention on Long-range Transboundary Air Pollution (CLRTAP), the European Commission, Global Atmospheric Pollution Forum and the Nordic Council of Ministers.

The discussions at the workshop built on a number of on-going and recently finalised international activities such as the revisions of protocols under CLRTAP, the on-going review of the EU Thematic Strategy on Air Pollution, and several initiatives in relation to Short Lived Climate Pollutants (SLCP) including those of the Climate and Clean Air Coalition and the Arctic Council. The CLRTAP is after the recent revisions of the Gothenburg Protocol and the protocols on heavy metals and POPs facing new challenges outlined in its Long Term Strategy. Several of the key items in the strategy were in focus in the discussions at the workshop. Several of the crucial issues in the the on-going review of the EU thematic Strategy on Air Pollution led by the EC were also brought up. Topics of particular interest were combined air pollution and climate change policies, actions for the control of emissions of reactive nitrogen, health impacts of air pollution, future effects-based international air pollution policies and the roadmap for going from regional to global air pollution policies. Future work on POPs and heavy metals under CLRTAP and other conventions was also discussed.

The key message from the workshop is compiled in a number of general conclusions and recommendations, which were agreed upon at a plenary session. These conclusions are presented in chapter 2 of the report. Each recommendation is followed by a "tag" indicating to which relevant organisation(s) the recommendation is directed. These recommendations are the results of discussions in seven working groups directed to themes of particular interest identified by the Program Com-

mittee. The outcome of the seven topical workshops is presented in chapter 3 of the report. The themes were:

- Air pollution and climate, including the role of short-lived climate pollutants (SLCP).
- Nitrogen – why is so little happening?
- Effect-based international air pollution strategies.
- Air Pollution Agreements – Going for Global Governance of the Troposphere.
- Air Quality and Health.
- POPs and Heavy Metals.
- Mid-term policies for Europe and its vicinity (with particular emphasis on the ongoing review of the EU Thematic Strategy on Air Pollution).

2. Conclusions and recommendations

2.1 Future direction of policy and science

- Air quality has improved during the past 30 years, but there is still work to be done to protect human health, ecosystems, crops, cultural heritage and to contribute to short-term mitigation of climate change. The effect-based approach – that has underpinned the Convention on Long-Range Transboundary Air Pollution to date – should remain the basis for further steps. (EB).
- Further emission reductions, especially from diesel cars, non-road mobile machinery and domestic coal, wood combustion and agriculture are needed to reduce long-term population exposure. (EB, European Commission).
- It is crucial that the latest proposed European mobile standards (Euro-6 and VI) will work as planned under real-world driving conditions. A process related to the new driving cycle and associated testing is underway in Europe. Member States will ultimately decide on the real world issue, based on a proposal from the Commission, but should ensure that their views are properly represented throughout the consultation process, in which views from industry currently tend to dominate. (EU Member States, European Commission, EB).
- The revised National Emissions Ceilings (NEC) Directive (proposal scheduled for adoption by the European Commission in 2013) could be used as a first step towards addressing emissions of the ozone precursor's methane and carbon monoxide for both air quality and health purposes, at the same time benefitting near term climate. This can be followed by similar actions on a broader international scale. (European Commission, EB, Arctic Council, CCAC).

- Emissions data on Black Carbon and knowledge of its impacts on health and climate should be further improved. This requires specific action by the Task Forces on Emission Inventories and Projections and Hemispheric Transport of Air Pollution as well as the Task Force on Health. (EMEP, TFEIP, TFHTAP, TFH, scientific community).
- In order to move towards improved protection of ecosystems from air pollution (in particular eutrophication and ozone impacts), development of indicators complementing critical loads and critical limits could be investigated. This includes air quality limit value for ammonia and regional emission ceilings for nitrogen and indicators relating nitrogen concentrations and deposition or ozone fluxes to impacts on ecosystems (such as "no net loss of biodiversity)". Such indicators are required for impacts assessments carried out in complement to analyses provided by the GAINS model. (EB, TFRN, WGE).
- A number of paths may be considered and further explored by the research community in order to assess benefits of air pollution reductions. These include the evaluation of ecosystems improvements and the benefits these entail for human health and the provision of ecosystems services. (WGE, EMEP, TFH, TFIAM, ICP M&M and other ICPs).
- The contribution to the reduction in air pollution and greenhouse gas emissions of structural changes in transport, energy and food supply as well as behavioural change will become increasingly important in the future. Energy efficiency measures, introducing renewables and switching from coal to gas are examples of structural changes. Further work is needed to explore ways to encourage sustainable and healthy lifestyles. (WGSR, TFIAM, TFRN).
- The integrated scientific approach including emissions, monitoring, modelling, integrated assessments, and policy scenario evaluations is essential and specific to the CLRTAP. It provides valuable support to further policy development and implementation, in cooperation with other conventions and programs. Improved emission inventories are needed in order to improve the scientific basis for policy development. Increased cooperation with EECCA countries on science and implementation is of high priority. (EB, EMEP, WGE, TFEIP, and other TFs/ICPs as appropriate).

- For both HM and POP, human and ecosystem exposures occur via a number of pathways and atmospheric emissions and long range transport contribute in varying degrees to the exposure either directly or indirectly (e.g. via uptake in food chains in remote areas). New scientific evidence of human health effects at low dose levels of HM and POP warrants further policy action to reduce atmospheric emissions and long-range transport. The unique characteristics of CLRTAP among the various international conventions and programs are the strong links between science and policy as well as the integrated scientific approach. CLRTAP should develop cooperation with other international conventions, policies and programs focussed on regulation, monitoring and assessment. In this context, CLRTAP can provide an infrastructure and a mechanism by which parties can meet many of their obligations to other international agreements (EB, WGSR, EMEP, WGE).

2.2 Communication

Communications from the International Air Pollution community must be responsive to the broad mix of outputs generated and the diversity in the assimilative capacities of the various recipients. Communication may relate to the status of air quality in a given area, international emission trends, local policy options and the outcomes of policy interventions. The respective audiences and relevant messages are varied and CLRTAP (including its subsidiary bodies) could together with other international bodies play a more pivotal and effective role in the design and delivery of messages from the wider international air community to all stake-holders within and beyond present networks.

- The meeting recommends the EB and the CLRTAP secretariat to consider its communication strategy, redesign its webpage and establish a position for a communications officer to manage internal communications and support external mainstream messaging efforts. (EB, CLRTAP secretariat).
- An effective communication strategy requires coordination of communication between Convention bodies, with other international conventions as well as with other target groups outside the Convention, such as policy makers and the general public. This may require information to be tailored for the target groups and presented via different media (EB).

- In regards to conveying messages to the public and politicians internationally, it is recommended to involve professional support to ensure that there is sustained mainstream media attention for air related issues through a variety of media (print, online, radio, television) and on all scales (e.g. local, national). This regular messaging can change the public perception of air quality, make adverse air quality impacts a reputational risk for industry, and so change the political context for regulation. (EB, European Commission, EEA, national administrations etc.).
- The achievements and potentials of CLRTAP and the role played by an integrated scientific approach should be actively promoted. The synthesized messages of these scientific efforts must be made easily understood for the public (EB and CLRTAP subsidiary bodies).

2.3 Outreach to the global scale

Concerted international action is crucial for the reduction of population exposure to long-range air pollution such as ozone and fine particles and for reducing damage to ecosystems. Due to the synergies between air pollution and climate change, air pollution control could effectively contribute to the mitigation of short-term and local warming.

- CLRTAP should take steps to open the Convention to parties outside the UN ECE, in recognition of the general character of the obligations of the Convention and to facilitate building upon the work of TF HTAP (EB and TFHTAP).
- CLRTAP should initiate discussions with other regional networks and relevant bodies on the appropriate elements of a Global Framework for Cooperation of Air Pollution. The intention would not be to have a global negotiating organisation but rather an agreed process for information sharing, policy coordination and to enhance capacity for managing transboundary and local air pollution issues. (EB, UNEP, GAP Forum).
- CLRTAP should invite the International Law Commission (ILC), established by the United Nations, to continue exploring the scope for a "*Law of the Atmosphere*," which would facilitate integrated action on climate change and tropospheric air pollution. (EB, UNEP, UN ILC).

- Scientific cooperation with other conventions and programs working on different aspects of air pollution, e.g. UNEP, the Arctic Council, AMAP, the Stockholm Convention and the Minamata Convention should be developed and co-funding should be sought where appropriate (EB, EMEP, WGE, UNEP, Arctic Council, AMAP, Stockholm Convention, Minamata Convention, CCAC, European Commission).
- An ad-hoc group with representatives for WGE, EMEP, WGSR should be formed to address potentials and actions to enhance cooperation and synergies on POPs and HM with other conventions, programs and policies, and also to evaluate possibilities for funding of these activities (EB).
- Climate change policy makers and national IPCC representatives from countries interested in the linkages between air pollution and climate change should propose the compilation of a special report on air pollution and climate change that would engage the IPCC, CCAC, and the air pollution community both globally and locally, including subsidiary bodies of CLRTAP. (National governments, IPCC, CCAC, EB, EMEP, WGE).

2.4 Outreach to the local scale

The meeting identified the importance of emission control measures on the local scale both with respect to urban and agricultural areas and encourages:

- Relevant bodies under the Convention to involve experts from local and city administrations, NGOs and experts from industry or agriculture in their scientific network (EMEP, WGE, TFIAM, TFH, TFRN).
- The Working Group on Strategies and Review, the European Commission and the parties to further develop standards for large animal production units and for products (Euro standards, Ecodesign, Non Road Mobile Machinery and machinery for manure application to agricultural land), that would facilitate meeting air quality limit values locally and halting the loss of biodiversity in designated nature protection areas, i.e. Natura 2000 areas (WGSR, European Commission, national governments).

- Local and national governments to reduce exposure of urban population to air pollution with additional incentives to reduce emissions from local combustion sources. Fuel switching, retrofitting and/or early replacement of vehicles and small-scale combustion installations, as well as incentives to reduce car mobility and energy use would have priority (European Commission, national governments, local administrations, WGSR).
- Local and national governments to develop reduction plans to bring nitrogen deposition, and ammonia and nitrogen oxides concentrations over designated nature protection areas, such as Natura2000 sites, down towards critical loads and levels (local administrations, national governments, European Commission).

2.5 Short and long term ambitions for the European Union

The meeting advises the European Commission in its present work on the Thematic Strategy on Air Pollution and related revisions of directives to consider:

- Including in the new NEC Directive a regular interim review of progress towards the emission targets (of the NEC Directive and the emission obligations under the revised Gothenburg Protocol) and require a scheduled national assessment process with Member States reporting on projected emissions and compliance progress. This may trigger additional action or infringement if a country fails to respond or fails to take action on persistent poor performance (European Commission).
- Making optimal use of the available technical abatement potential in 2025 and move towards long term "no significant impacts on health and ecosystems" by 2030 at which time it should be possible to incorporate the potential co-benefits from the climate and energy package and the Common Agricultural Policy revision (European Commission).
- Stimulating technological innovations needed for cleaner air. (European Commission).

2.6 Capacity-building and information infrastructure

International air pollution policies have, since the trans-boundary transport of pollutants was recognized, been based on scientific evidence and long-term monitoring and these activities are still of sustained and significant importance for the policy work. The meeting advises:

- Parties to sustain the monitoring programs under EMEP and WGE with a viable number of monitoring sites (parties to the CLRTAP, EMEP, WGE).
- The European Commission to require ecosystem monitoring under the NEC Directive, which should build on existing monitoring systems (European Commission).
- Parties to maintain the scientific capacity within the CLRTAP and enable national experts and scientists to actively participate in its scientific network as well as the financing of research and monitoring activities. This should also include the awareness of air pollution and the improvements of technical capacities in the EECCA countries (parties to the CLRTAP).
- Scientific bodies and national and European policy makers to promote the prioritisation of topics relevant for CLRTAP in available (co-)funding programs (e.g. LIFE, Horizon 2020, Structural Funds, European Commission, national governments and agencies).
- CLRTAP and its subsidiary bodies and parties to engage with other international and national organizations through the Group on Earth Observations (GEO) Air Quality Community of Practice to take advantage of the progress in information technology to improve information access and exchange within the Convention and the broader global air quality community. (EB, EMEP, WGE, TFHTAP).

3. Working Group Reports

3.1 WG 1: Air pollution and climate, including the role of short-lived climate pollutants (SLCP)

Chairs: *Bill Harnett* and *Øystein Hov*

Participants: *Nadine Allemand*, *Mark Barrett*, *Jean-Guy Bartaire*, *William Collins*, *Anna Forsgren*, *Alf Grini*, *Sigmund Guttu*, *HC Hansson*, *Wojciech Jozewicz*, *Niko Karvosenoja*, *Karin Kindbom*, *Adam Kristensson*, *Lina Lagunavičienė*, *Joakim Langner*, *Annika Markovic*, *Olivier Parks*, *Pam Pearson*, *David Simpson*, *Vanisa Surapipith*, *Gaston Theis, Kjetil Tørseth*, *Milan Vana*, *Sonja Vidie*

3.1.1 Questions prepared for the working group in advance

In advance of the meeting, a set of questions was prepared for the working group and posted on the web site:

- Scientific understanding of short lived climate forcing pollutants (SLCFs), and their climate effects. A particular question is regional vs global, i.e. does Europe, North America or LRTAP region overall health and climate benefit preferentially from reductions of SLCFs mitigation in those areas?
- What are the current levels of emissions and the projected trends for the particular SLCFs? Regionally and Globally?
- What are the current concentrations of SLCFs?
- What are the options for control measures to mitigate SLCFs?
- How can the climate benefits be accommodated in air quality policy? Can SLCFs be accommodated in climate policy? What metrics and techniques can be used to estimate the benefits?
- What kind of research studies have been done or are under way looking at issues and relationships of strategies to address climate and air quality?

- What strategies make the most sense when trying to address local/urban air quality health and environmental issues and pollutants like short lived climate forcers? Diesel engines? Woodstoves? Agriculture burning?
- What research is needed to better assist air quality planners to incorporate climate concerns or short lived climate forcers into their planning and regulatory structures? Better emission inventories? Modeling? Control strategies?
- For some climate pollutants like methane or CO2, local strategies will not benefit local air quality as quickly. However, some reduction strategies like getting more efficient motor vehicles, increasing transport systems and thereby reducing the amount cars are driven, moving to electric vehicles could all help reduce climate and air quality pollutants. Is there a complete list of those kinds of strategies? Are countries promoting these strategies in their air quality planning to achieve the appropriate air quality standards? What about other energy efficiency approaches?
- Where do you think opportunities to maximize air quality and climate benefits are being missed today? What is needed to stop that from happening? More dissemination of information on strategies? More research? Information sharing forums/websites?
- Are there obstacles or disincentives in the air quality planning of countries from considering climate issues as you develop strategies?
- Do industry and the general public understand the linkages between air quality and climate or is greater education needed to get broader support for action?
- What are the benefits including reduced costs for transportation (e.g., more efficient vehicles) and lower costs for heating (more energy efficient buildings)? Is information on costs and benefits readily available so consumers can make informed choices?
- Would we change future efforts to continue to bring down PM knowing that BC-rich sources of PM might get us more climate benefits? Would we want to do that action if there are some health tradeoffs (e.g., at regional levels) to consider? Are there other such climate/air quality trade-offs?
- What should be the 5 key next steps on climate and air quality linkage issues coming out of the meeting that would have the greatest benefits?
- What should be the 5 key recommendations on future actions and who are they directed to?

3.1.2 Agenda

Also distributed in advance was the agenda for the meeting. Several participants were approached to give introductory talks to stimulate the discussion, as indicated in the agenda:

- Introduction (30 minutes) [10:00am to 10:30am]
- Introductions of Working Group Members
- Overview of Questions and Goal of Group
- Review and Discussion of Agenda
- Presentations (10 minutes each)[10:30am to 11:15 am]
- Scientific understanding of SLCPs and their climate effects. A particular question is regional vs global, i.e. does Europe benefit preferentially from European SLCP mitigation? (William Collins)
- Overview of International Fora working on SLCP (Harnett)
- Background on Black Carbon Emissions and Concentrations (Harnett)
- Black Carbon Control Technique Guidance Document (LRTAP EGTEI)
- Discussion of Questions (11:15am to 12:00pm)
- Lunch (12:00pm to 1:00pm)
- Discussion of Questions (1:00pm to 1:30pm)
- Presentation on optimization of trade-offs and co-benefits in Air Quality and climate change mitigation (Marcus Amann, IIASA) (10 minutes presentation and discussion, 1:30pm to 2:30pm)
- Discussion on Questions (2:30pm to 4:00pm)
- Discussions on Recommendations (4:00pm to 5:30pm)

3.1.3 Outcome and recommendations from the working group

The working group attracted 25 participants. On the basis of the questions provided, talks given and the discussion the group, the following recommendations were agreed upon and endorsed for presentation in the plenary session on 26 June 2013:

- Scientific evidence from TFHTAP shows that specific controls on methane and CO give important dual benefits for ozone air quality and near-term climate. The ozone benefits are particularly on the hemispheric background. The climate benefits come through changes in ozone and methane. These climate benefits will offset much of the warming from SO2 controls.

- Reducing the background level of ozone requires controlling methane and CO emissions on a (near) global basis.
- CO and methane are hemispheric/global pollutants. CLRTAP and the CCAC are appropriate venues to address this. The National Emissions Ceilings (NEC) within the EU could be used as a first step towards addressing CO and methane for ozone, air quality and health purposes, followed by similar actions also on a broader international scale.
- There are synergies between the control of air pollution and global warming agents/greenhouse gas emissions; and further between these and other objectives such as those related to energy security and water or soil pollution. It is useful to identify where these synergies are positive across the board; win-win combinations. These positive synergies generally enhance the political feasibility of policy implementation (as there is no downside) and reduce the total cost of meeting air pollution, greenhouse gas and other objectives. Examples:

Measure	AP	GHD	Energy security
Control methane leakage	+	+	+
Energy efficiency	+	+	+
Renewables (wind, solar)	+	+	+
Switch from coal to gas	+	+	

- Among the various pollutants which LRTAP has worked on, emission factors and inventories for black carbon, organic carbons and other particulate matter are the most uncertain. TFEIP is developing emission factors for the development of emission inventories for black carbon to begin to address these issues. However, there is also a need for:
  a) Such inventory guidance for black carbon to be translated into Russian so we will get full emission inventories across the LRTAP Region.
  b) Further technical work by parties to improve the emission factors for the different categories and pollutants including through emission testing, inverse modeling and ambient speciated monitoring and share such work with TFEIP.
  c) Emission measurement methods used for developing emission factors of these pollutants need to be harmonized.
  d) TFEIP should address this issue.

- Black carbon should be considered mainly as a regional pollutant for both air quality and near-term climate purposes, especially in the Arctic and alpine regions. Reductions in black carbon sources, including from domestic heating (both biomass and coal) and from open field and forest burning, have strong potential for the CLRTAP countries to add health and Arctic climate benefits in addition to those taken by the Arctic Council. This is because emitted co-species with black carbon from these biomass sources that otherwise might cool the atmosphere, are still warming over the reflective surface of ice and snow. The strength of SLCP mitigation lies in slowing the rate of change in the radiative forcing, especially in snow or ice covered regions. Because of the rapid disappearance of snow and ice, it is important that the Gothenburg Protocol signatories act as quickly as possible to address black carbon as part of their PM2.5 commitments under the revised Protocol. The UNEP/WMO Assessment also noted the importance of taking action on black carbon and methane in the 2010–2030 time frame for maximum climate benefits. In addition to its impact on background ozone levels for air quality purposes, for near-term climate benefits methane reductions also benefit the Arctic by two or even three times more than the global mean climate benefit. TFIAM, AMAP and others are addressing these issues.

3.1.4 Useful references

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3.2 WG 2: Nitrogen – why is so little happening?

Chairs: *Wilfried Winiwarter* and *Jan Willem Erisman*

Participants: *Sara Alongi Skenhall, Fennia Carlander*, *Francisco Ferreira*, *David Fowler*, *Jakob Frommer*, *Mikael Johannesson, Kajsa Lindqvist*, *Max Posch*, *Till Spranger*.

3.2.1 Formal setting

The workshop was attended by 13 people from 7 countries. In order to stimulate and focus the discussion, a total of five short papers ("commentaries)" were given, representing topics from two further countries (remote presentation via internet and paper sent via e-mail, respectively). The commentaries covered the "success stories" in nitrogen abatement, as well as the not-so-successful situations, and compared the situation of nitrogen-affluent regions with those suffering from undersupply. The presentations led to lively discussion and some generalizations over the very different situations occurring in Europe and the UNECE area.

3.2.2 General observations

A review of different country situations and experiences, mostly based on EEA databases, made clear that the release of nitrogen compounds (NO_x, NH3, N2O and nitrate leaching) has been tackled with considerable success, with substantial reductions in emissions reported in many countries. Emission reductions have been largest for oxidized nitrogen compounds, averaging 50% over the last 20 years over the EU countries. The reductions in emissions of reduced nitrogen have been much smaller over Europe as a whole (10-25%). But there are exceptions, Denmark and the Netherlands have made much larger reductions (in the area of 50%).

Monitoring data show reductions in concentrations and deposition, but in general these reductions for both oxidized and reduced nitrogen are clearly smaller than the reported reductions in emissions, indicating a need for further action. A number of different reasons were identified responsible:

- In contrast to other pollutants (SO2), where emission reductions are an order of magnitude, it has been more difficult to reduce emissions of nitrogen, especially ammonia. The resulting smaller reductions produce smaller signals in the observed concentration and deposition data.
- Changes in the atmospheric processing of NO_x and NHy compounds with time (due to changed atmospheric composition) has led to changes in the atmospheric residence times, thus affecting concentrations and also patterns of deposition.

  Non-linearities in emission deposition patterns exist at local, regional and country scales and only disappear on large scale (where the overall mass balance is maintained). As a consequence, the success stories presented were mixed, with some notable successes, in Denmark and the Netherlands. However over Europe as a whole, nitrogen deposition remains substantially in excess of damage thresholds for the health of the natural environment and human health. Proven success is mixed with new challenges – deriving from long-range transport of air pollution (including intercontinental transport) and new sources as e.g. urban ammonia emissions from waste collection. Within the framework of the common agricultural policy of the EU the nitrogen challenge has been addressed only to a limited extend in the past. Only two countries that strictly addressed agricultural nitrogen (e.g., by way of compulsory farm nitrogen balances with ambitious limit values based on successful advisory systems) were successful in their reductions due to sincerity of efforts. These were the Netherlands (a notorious hotspot in nitrogen emission and deposition) and Denmark, where pollution became visible in the form of algal blooms in the Baltic Sea. These two countries, despite large reductions in ammonia emission, retain a highly competitive agricultural industry. The substantial achievements in the Netherlands have not continued to further drive down emissions and deposition, which are still high in a European perspective, and current Nr deposition in the Netherlands remains well above thresholds for effects on semi-natural ecosystems and human health in the case of particulate matter and ozone.

3.2.3 Conclusions

Ammonia is the single compound that is considered central to the issues and is a key objective of additional control measures, for the following reasons. Ammonia emissions dominate N deposition and effects on sensitive ecosystems. Efforts directed towards ammonia abatement are considered to be most effective in reducing ecological effects. Efficient measures exist to reduce emissions at rather low (if at all) cost and they have been identified. Most prominently, low emission techniques in manure application (immediate incorporation, manure injection or trailing hose/shoe) will allow additional nitrogen be added to soils and plants and thus reduce the needs (and the costs) of mineral fertilizer. Further abatement measures exist in animal husbandry as well as in plant production, which too often are not taken advantage of. A considerable share of emissions is caused by large industrial style animal production units, which can be addressed relatively easily by appropriate measures. Emission reductions of nitrogen oxides (which are relevant for the same reasons as ammonia) also have not been too successful in removing negative impacts, at least mechanisms and policies are in place that needs to be enforced, but such mechanisms need to be introduced for ammonia.

Ammonia has been identified as a compound that adversely effects vegetation, and a critical level for ammonia has been established. Moreover, ammonia contributes to the formation of secondary particulate matter, an important component of both rural and urban PM pollution. Many cities report ammonium nitrate as a significant fraction of PM10 in situations of limits exceedance. The ammonium nitrate is generally imported from the rural landscape and cannot be addressed by local action.

3.2.4 Key Recommendation

The WG recommends establishing a limit value for ammonia in the ambient atmosphere. This proposed limit value aims to protect sensitive ecosystems (such as Natura 2000 areas) and will facilitate a reduction in the formation of secondary PM, thus indirectly mitigating air pollution-related effects on human health. Sound evidence exists that quantitatively links ammonia concentrations and the environmental effects discussed.

This ammonia limit value is intended for implementation at an EU level. In defining measures to achieve compliance, regional emission ceilings might be considered an adequate approach by individual countries.

3.2.5 Accompanying measures

Implementing an ammonia limit value will need a number of prerequisites. First of all, an adequate level of the limit value needs to be established. This value needs to consider ecosystems and, if possible, the human health. Using information about the link in concentrations and effects, the TFRN should start collecting the scientific evidence available. With a focus on the protection targets, also monitoring concepts and requirements should be established (e.g., distance of measurement point to a point source as an animal house).

Ammonia emissions are also linked to the choice of consumers. Consumption of meat is known to be a key driver for applying nitrogen in animal feed production and loss to the environment in manure processing. In order to cover and guide the behavioral changes required, establishing and improving concepts of nitrogen footprints is a key factor. INI-Europe (the European section of the International Nitrogen Initiative) is a body providing interest and expertise to cover that task.

Extending from individuals, food choice is an issue of procurement in food service institutions. Here behavioral changes may be initiated, too. The national food agencies and their respective EU counterpart are institutions capable of addressing the issue.

It will be essential to provide and communicate success stories, i.e. a proof of evidence that ammonia abatement works and concentration limits are achievable. It can be the task of NGO's, but also the EEA, to get involved here.

3.2.6 Timeline

The accompanying measures should start as early as feasible ("now"). While ammonia effects are firmly established and quantified (including critical levels, loads and their exceedance), legally implementing an ammonia limit value needs some additional work, as establishing monitoring concepts and criteria. Thus a realistic scope for implementation is the revision of the air quality directive, currently announced for the second half of this decade.

3.3 WG 3: Effect-based international air pollution strategies

Chairs: *Brit Lisa Skjelkvåle*, *Maximilian Posch*, *Filip Moldan*

Participants: *Anna Engleryd*, *Martin Forsius*, *Harry Harmens*, *Mike Holland*, *Alan Jenkins*, *Sergejus Konkovas*, *Anne-Christine Le Gall*, *Lars Lundin* (part.), *Rob Maas* (part.), *Tim Oxley*, *Irina Priputina*, *Thomas Scheuschner*, *Harald Sverdrup*, *Johan Tidblad*

To stimulate discussions, the following five short presentations were given:

- R Maas: "Effect-oriented indicators for integrated assessment."
- H Harmens: "Impacts of ozone on vegetation: policy-relevant indicators."
- J Tidblad: "What is the current status of the effects on materials?"
- A-C Le Gall: "Future effects-based air pollution control strategies: the need for new approaches?"
- M Holland "Air pollution: Good News!"

The Working Group (WG) discussed only effects on ecosystems and materials. Health effects were discussed in WG 5; but many of the points raised and discussed pertain to health effects as well. It should also be noted that there is a potential overlap with WG 2 concerning nitrogen (N) issues.

The set-up of – and discussions in – this WG were partly triggered by the perception that in the final round of negotiations leading to the revised Gothenburg Protocol the effect-based approach for determining emission reductions was not used (maybe driven by the unfavourable economic conditions). Also a lack of proper communication of results was suggested as a reason for the low profile and use of effect-based research in recent emission reduction agreements.

3.3.1 Key Recommendations

- The WG recommends that the Parties to the LRTAP Convention continue to support the effects-based work (policy-relevant science and monitoring) on a viable level, especially as the Parties themselves and other multi-national bodies (such as the EU) also (can) use the results.
- The WG recommends that the Executive Body of the LRTAP Convention establishes the position of a communication officer, whose main task is the communication between the Convention and the outside world (policy makers and the public at large).

3.3.2 Policy-relevant science

- Effects (on ecosystems, health, materials) are the basis and incentive for emission reductions!
- The scientific work of the Working Group on Effects (WGE) (and other science-related bodies under the Convention) has to be policy-relevant, but also high-quality, peer-reviewed and (preferable) published.
- It is recognised that (transboundary) air pollution effects no longer dominate the agenda.
- Thus, links to other impact categories, such as climate change and biodiversity – as emphasized in the Long-term Strategy of the Convention –, become ever more relevant, especially to identify win-win strategies.
- Also, new indicators, reflecting e.g. changes in biodiversity due to air pollution, should be developed and made useable in integrated assessment (IA).
- In addition to N, sulphur is still important as, e.g., soil pH is a key abiotic driver of biodiversity changes and the loss of archaeological heritage (in addition to climatic variables).
- For IA models (IAMs) science/indicators have to be simplified. Thus, IA should be always be accompanied by so-called impact (formerly known as "ex-post)" analyses – carried out by the WGE with the help of EMEP –, which make full use of the knowledge on effects not included in IAMs, such as damage to materials (esp. landmark buildings or structures), results of dynamic modelling (time lags), influence on C cycle, food security, trends in specific (popular) species, restoration costs of nature areas, etc.
- The focus on nature protection areas (e.g. Natura2000 areas in the EU) could be advantageous, as arguments whether action is required are (more or less) mute.

- Since health effects "sell" better, links between ecosystem health and human health should be researched/established (see, e.g., *Nature* 494: 230) and possibly quantified.
- The concept of ecosystem services (ES) is a useful framework that could/should be embraced by the WGE. It could help to structure problems and their prioritisation.
- The monetisation of effects, especially on ecosystems, remains a problem, or even controversial. But viewing them as ES could help at least to better classify/prioritise problems.
- Decreasing peaks and the increasing background of several pollutants require (a) the establishment of indicators dealing more with lower-level chronic exposure rather than peak exposure, and (b) the collaboration with groups dealing with hemispheric problems (e.g. HTAP, CCAC, IPCC).
- Monitoring networks are needed for ground-truthing policy-relevant science as well as for detecting new impacts or the recovery from past impacts.
- Present monitoring networks are already curtailed to such an extent that further reductions might jeopardise their meaningful existence. However, every opportunity should be exploited to make monitoring networks serve multiple clients (national and international) and other problems (e.g. effects of climate change).
- Monitoring is also the key for every efficiency and sufficiency assessments of policy measures.

In summary
High-quality, policy-relevant science on air pollution effects has been, and shall be, a key element underpinning (transboundary) air pollution agreements.

3.3.3 Communication

- Communication within the Convention is the primary task of its subsidiary bodies. However, communication has to be a two-way process, i.e. any (non-routine) communication (report) from "below" should receive honest feedback from "above" (and not only be "taken note of)".
- Reporting within the Convention can certainly be improved, and any guidance from the EB is welcome. Maybe the number (and size) of official reports can be reduced?

- Common reporting by WGE and EMEP might be a way forward. In this context common "country reports" could help keeping Parties engaged.
- Reporting/publicising to outside audiences (i.e. outside the LRTAP Convention) has not been paid enough attention by many groups within the Convention.
- New(er) ways of communication (websites, social media, apps) should be embraced. However, the WG recognised that the experience and capacities within the Convention are limited in this respect.
- All reporting should have a defined target group: policy makers (at various levels), special interest groups or general public. Also the geographic reach should be taken into account, i.e. local, national, international.
- Any short, "summary," "executive" report/brochure has to be backed by scientific underpinning/reporting (which does not need to be scrutinised by the EB, but can easily be retrieved).
- It has been recommended to also communicate good news (people are sometimes tired of doomsday news). E.g., we know there are effects and there are solutions available!

In summary
There is room for improvement in communicating results on air pollution effects, both within the LRTAP Convention as well as to policy makers at various levels and the general public.

3.4 WG 4: Air Pollution Agreements – Going for Global Governance of the Troposphere

Chairs: *Terry Keating*, *Johan Kuylenstierna* and *Richard Mills*

Participants: *Andre Zuber*, *Liisa Jalkonen*, *Christian Lange Fogh*, *Peringe Grennfelt*, *Mindaugas Gudas*, *Albena Karadjova*, *Annika Markovic*, *Gina Mills*, *Lars Nordberg*, *Kimber Scavo*, *Katsunori Suzuki*, *Michael Walsh*, *Martin Williams*, *Roald Wolters*, *Hidemasa Yamamoto* and *Frank Dentener*

3.4.1 Introduction

As understanding of air pollution has increased, the more important the global scale has come to appear. In particular, attention is increasingly focused on air pollution interactions with climate change, with the development of global approaches to reducing Short-Lived Climate Pollutants

and the increasing importance given to the air quality co-benefits of climate strategies. Meanwhile, the extent and significance of damage to health and to crops have become increasingly apparent as their global scale has come into focus, and tropospheric ozone and particulate matter, in particular, are increasingly seen as hemispheric problems.

Despite successful negotiation of some global agreements (e.g. stratospheric ozone and POPs), extensive scientific work at the hemispheric scale (e.g. the Task Force on Hemispheric Transport of Air Pollution), the LRTAP Convention's extensive suite of regional protocols, and the beginnings of regional cooperation in Asia, Latin America, and Africa, it is arguable that much more needs to be done. In particular, there is no regulation at the global scale of the two transboundary pollutants that are most damaging to health – small particulate matter and tropospheric ozone.

The aim of this session was therefore to identify action that could be taken at the global scale to promote the further reduction of air pollution problems globally. It reviewed the need for enhanced global governance of air pollution, explored the pathways by which this might be achieved, and tried to identify constructive steps forward that could be taken by the major institutions and interests involved.

The co-chairs had prepared a background note that was provided to the participants in advance. The note identified a number of major issues and questions to guide the presentations and discussions. In the morning there where a number of invited presentations to further introduce the issues.

Talks (morning)	**Presenters (and istitution)**
Developing the role of global governance to air pollution issues: an introduction to the session	Johan Kuylenstierna (SEI – the Stockholm Environment Institute)
Developments in international policy and governance i. a global perspective ii. perspectives from Asia	Richard Mills (IUAPPA – the International Union of Air Pollution Prevention and Environment Protection Associations) and Katsunori Suzuki (Kanazawa University, Japan)
The scientific and monitoring base for global governance	Terry Keating (US EPA)
Harmonization and convergence: the lessons of international developments in vehicle emissions control	Mike Walsh (ICCT – the International Council for Clean Transportation)
Climate and Pollution: the voluntary approach of Climate and Clean Air Coalition (CCAC)	Annika Markovic (Environment Ambassador, Ministry for Foreign Affairs, Ministry of the Environment, Sweden)
Potential contribution of the LRTAP Convention	Martin Williams (Kings College, London; CLRTAP EB Chair)
Conclusions: major issues and defining the next steps	Terry Keating (US EPA)

The afternoon session discussed the major issues introduced in the background note and morning presentations. Some highlights of the discussion are summarized below. Based on the discussion the group developed a series of recommendations directed at specific audiences.

3.4.2 Discussion

There is a patchwork of different initatives dealing with different parts of the air pollution problem at different scales – e.g. CCAC at the global scale dealing with products of incomplete combustion (BC etc.), methane and aspects of tropospheric ozone (as well as HFCs); regional bodies dealing with all air pollution (e.g. LRTAP Convention and emerging agreements – Malé Declaration, EANET, etc.); and Clean Air Asia working at the urban scale in Asia. However, there is no comprehensive global governance of air pollution.

There are a number of reasons to improve global governance of air pollution including:

- Intercontinental flows of PM (especially inorganic aerosols – sulphate, ammonium and nitrate) and ozone (NO_x is not addressed as a precursor in CCAC), which have major impacts on health, and are not sufficiently addressed by existing international agreements or programs.
- Areas with the biggest air pollution problems have the least capacity to deal with the issues. Technical assistance is *ad hoc* and not globally organised. And there is a need to increase equity in terms of access to clean air for people across the world.
- Linkages between air pollution and climate change require convergence at global scale.

There is a need for capacity building and knowledge transfer to develop the basic building blocks for air pollution management – such as emission inventories, monitoring of air pollution concentrations and deposition, atmospheric modelling, impact assessment and understanding of the technologies and policies to reduce emissions. The CCAC is addressing some of these issues such as helping countries to assess emissions and impacts as part of national planning, but it is not the function of the CCAC to undertake new scientific activities such as monitoring and research on impacts. Some of the existing regional agreements have focused on these aspects, but significant disparities remain across the globe.

The need for enhanced global governance of air pollution reflects the need to allow transboundary issues to be better addressed, but also to better address local and regional air pollution problems that are common problems affecting many regions. Despite the commonalities in air pollution problems, policy solutions, priorities, and opportunities may differ significantly in different regions due to a variety of environmental, economic, technological, political, and social factors. Therefore there is a need for flexibility, allowing diverse approaches to the development of policy in different regions and contexts.

The climate and air quality linkages are important and addressing these issues in an integrated fashion has many merits. The CCAC is an important global initiative that is acting as a significant global catalyst for discussions linking air pollution and climate change and it is very important that this be successful. However, there are issues that link air pollution and climate change that are not considered by CCAC and where policy development is not integrated. For example, the CCAC is dealing with primary particle emissions affecting health and climate (BC, OC) but not specifically addressing the inorganic sources of secondary PM (SO_4, NO_3, NH_4) and their impacts on climate, health, and ecosystems (acidification and eutrophication).

Enhancing the global governance of air pollution includes engaging and motivating different actors including national governments, urban authorities, large companies, NGOs etc. There are new technologies that offer opportunities for enhanced information flows and, if harnessed properly, collaboration, including developments in distributed information management systems and earth observing satellites.

In taking forward the further development of global governance there are a number of other key issues that need to be considered. One is the lack of understanding of the impact of globalisation and trends in such areas as trade and development on the trajectory of air pollution emissions. Here, an example of a globalised driver is the transport sector, where the development of increasingly stringent emission standards in some regions affects the technological development of engines generally which should improve emissions in all regions. If these linkages are understood then it may be possible to understand better how such drivers can be harnessed to the benefit of air quality globally.

Other issues include how improved global governance could strengthen information and capacity building on air pollution; and increase the chances of better integration of air pollution and climate change and ease interactions with UNFCCC.

It is important that new developments enhance existing initiatives and do not duplicate or damage the progress of current regional air pollution networks and initiatives, nor that of the CCAC, but rather draw on their experience. This points to the need for care and flexibility, and close co-operation with organisations such as LRTAP, CCAC, UNEP and the regional initiatives such as the Malé Declaration, EANET, ASEAN Haze Protocol, and representatives of the LAC Ministerial Agreement: and organisations at urban scale such as Clean Air Asia, Council of Mayors, and private sector bodies such as the motor manufacturer associations. An important contribution to enhanced global governance of air pollution will also be better communication of air pollution issues to different audiences perhaps focusing in particular on health impacts.

There are a number of existing institutions that could contribute to enhanced global governance and cooperation on air pollution; each with its own strengths and limitations. Ultimately, there is a need for one or more champions to emerge that are able to raise funds and catalyze action across the global scale to address the remaining gaps described above. In the meantime, there are incremental steps that some organizations can take that would help move in the right direction.

The LRTAP Convention can play an important leadership role, setting an example for other regions to follow, reaching out and supporting the work of other regional bodies, and raising awareness of air pollution issues at the international scale. One step that the Convention could take is to modify the Article 14 provisions to open the Convention to participation by parties outside the UNECE. Whether or not countries outside of the UNECE sign up, the act of opening the Convention would send a constructive message to the rest of the world about the global nature of the air pollution problem, and the willingness of the LRTAP Convention parties to work with others. In addition, the LRTAP Convention could actively reach out, by sending representatives to meetings of other bodies or by organizing joint meetings with other bodies, to engage with other organizations about what their needs are for cooperation and what types of efforts may be organized globally. The LRTAP Convention could also contribute to global efforts to improve the accessibility and interoperability of earth observations and information being organized through the Group on Earth Observations (GEO) and its Air Quality Community of Practice.

The IPCC could contribute to furthering the understanding of air pollution-climate linkages and advance global governance of these issues through the process of developing an IPCC Special Report on Air Pollution and Climate Change. At a minimum, a special report could bring together

the relevant topics that are currently scattered in different chapters of the WG1 (Physical Basis) report and expand on the limited treatment of the issues in WG2 (Impacts) and WG3 (Mitigation) reports. There is a significant amount of on-going research that could be summarized and reported. The process of developing the special report could contribute significantly to advancing global cooperation if the IPCC used the opportunity to bring the climate research community together with a wide range of experts from the air pollution community. The assessment process would generate a number of new analyses, create opportunities for new expert interactions, and build relationships that are likely to continue beyond the production of the report. The report would be widely considered to be an authoritative reference and receive a high level of attention. There is a risk, especially if the process is less inclusive, that the report focuses only on global and long-term perspectives and its conclusions are not constructive with respect to local and regional air quality management.

3.4.3 Recommendations

The meeting recognised the global nature of many atmospheric issues, the world-wide occurrence of many atmospheric issues, and therefore the merits of enhanced global cooperation. It recognised that there is a patchwork of initiatives and agreements at regional to global scales (e.g. LRTAP Convention, CCAC, Malé Declaration, EANET, Asia Co-benefits Partnership etc.), but no comprehensive global framework for cooperation on air pollution issues. The meeting, therefore:

- Asks the LRTAP Convention Executive Body (EB) to take steps to open the Convention to parties outside the UN ECE, in recognition of the general character of the obligations of the Convention and to facilitate building upon the work of TF HTAP;
- Invites the LRTAP Convention EB to open discussion with other regional networks and relevant bodies on the appropriate elements of a Global Framework for Cooperation of Air Pollution, particularly to improve coordination and information sharing and to enhance capacity for managing transboundary and local air pollution issues;
- Requests countries interested in linkages between air pollution and climate change to consider organizing, through the IPCC or other process, the development of a special report on air pollution and climate change that would engage the IPCC, the climate research community, CCAC, and the air pollution community, globally;

- Encourages the UN Law Commission to continue to explore the scope for a "Law of the Atmosphere" which would facilitate integrated action on climate change and tropospheric air pollution;
- Invites the GAP Forum to widen its interest, from developing linkages between air pollution networks and mechanisms, to clarify the role of broader trends and drivers affecting air pollution, including globalisation and trade;
- Requests the LRTAP Convention EB, along with secretariats and coordinating centres of other regional agreements, and the WMO, to engage through the Group on Earth Observations (GEO), to take advantage of the progress in information technology to improve information sharing and bring these communities together.

3.5 WG 5: Air Quality and Health

Chair: *Göran Pershagen*

Participants: *Göran Pershagen*, *Tom Bellander*, *Titus Kyrklund*, *Tanja Lahtinen*, *Stefan Reis*, *Marie-Eve Heroux*, *Katja Asmussen*, *Anna-Carin Ohlin*, *Karin Sjöberg*, *Harald Perby*, *Annette Peters*, *Anita Matic*, *Ebba Malmqvist*, *Sven-Göran Eriksson*, *Hester de Boer*, *Martin Lutz*, *Lars Gidhagen*, *Lars Barregård*

Health effects are an important driver of air pollution policy. However, current standards in the EU or US do not meet WHO air quality guidelines for protection of human health. Furthermore, these standards are violated in several areas. The purpose of the Working Group discussions was to arrive at policy relevant conclusions for health protection related to air pollution. In addition, cobenefits of measures in relation to climate were considered. The discussion centered around five questions which constituted the basis for conclusions and policy recommendations.

What new evidence of importance for the risk assessment has emerged on health effects regarding specific air pollution components?

- Evidence for health effects from PM2.5 has strengthened.
- Evidence for health effects from PM2.5–10 is emerging.
- Health effects related to proximity to roads are not explained only by PM mass (e.g. PM2.5 or PM10).

- Evidence has accumulated that primary emissions from combustion (e.g. from road traffic and wood burning) are related to adverse health effects.
- More quantitative estimates are needed of long-term health effects of primary emissions indicators (e.g. BC, ultrafines). EC and national funding agencies should prioritize such research.
- There is new evidence that NO2 is associated with short-term health effects, even below current EU standards, and at least in part attributed to NO2 per se.
- For ozone there is new evidence for long-term health effects, in addition to effects of short-term exposure.

Are certain groups of the population particularly vulnerable to the adverse effects of air pollution?

- Evidence is accumulating that early exposure to air pollution (prenatally or early in life) is associated with impaired lung function development and other health effects which may also be of importance later in life.
- There is new evidence that air pollution is associated with adverse birth outcomes and pregnancy complications.
- There is emerging evidence that adults with common chronic diseases are particularly vulnerable.
- Special precautions should be taken by the appropriate authorities in order protect children and other vulnerable groups.

Which measures should be prioritized for human health protection in relation to air pollution?

- Reducing the effects of long-term (months to years) population exposure should be the primary goal.
- Short-term monitoring and standards are needed to timely assess the effectiveness of air quality management, and to adequately inform the public.
- Concrete measures like low-emission zones or improved local combustion appliances should consider both long-term and short-term exposure.
- Measures in response to high levels of particles should focus on reducing primary emissions from combustion sources.
- Vulnerable groups need to be considered.

What is the role of local, regional and long-range transported emissions of air pollutants for adverse health effects?

- Evidence is clear that all these source levels are important for adverse health effects.
- Concerted international action is crucial for reduction of population exposure to long-range air pollution such as ozone and accumulation mode particles. Which preventive measures have the highest priority considering health risks related to both air pollution and climate change?
- Low-emission transport and energy systems and technologies should be promoted.
- Reducing BC emissions (e.g. from diesel, coal and wood combustion) is beneficial for population health and mitigating short-term climate forcing.
- Reduction of combustion emissions of NO_X, CO and methane (e.g. from diesel and wood combustion) is also of importance for mitigation of short-term climate forcing as well as of health and environmental effects by decreasing ozone formation.
- Development and implementation should be speeded up of strict standards for emissions from new and existing small-scale solid fuel combustion, non-road mobile machinery and shipping.

3.6 WG6: POPs and Heavy Metals

Chairs: *John Munthe*, *Katja Kraus*, *Matthew Macleod*

Participants: *Petra Hagström*, *Agnes Petendi*, *Andreas Beguin*, *Tor Johannessen*, *Simon Wilson*, *Ramon Guardans*, *Donatas Iliška*

3.6.1 Driving forces for continued work on heavy metals and persistent organic pollutants

Note: No health experts participated in the working group on persistent organic pollutants (POP) and heavy metals (HM). Information about health effects of HM and POP was summarized from external information sources and participants in the working group on health effects (Professor Lars Barregård). Some of the key health related aspects of HM and POP that provided a basis for discussions in the working group were:

- As for other air pollutants such as PM and NO_x there is growing evidence of human health effects from HM and POP (and from chemicals in general) at low exposures. Given the increasing epidemiological evidence of low-dose effects, the present concepts of thresholds or safe exposure levels are not sufficient. The focus for future policies should be to reduce exposures to a minimum.
- The cadmium exposure level of the European population is above the effects level with increased risks for osteoporotic fractures and kidney effects (PHIME, 2011). Recent research also strongly indicates that Cd exposure increases cancer risks (WHO 2013) and the risk of cardiovascular disease. Biomonitoring shows that the levels of cadmium exposure are not declining.
- Exposure to methylmercury via fish consumption increases the risks for cardiovascular disease in adults but these effects are compensated by the positive effects of fish-eating. Negative effects on foetuses exposed via the mothers' consumption of fish can likewise be compensated unless exposure is high. Nevertheless, a recent EU study recommends to avoid consuming fish species high up in the food chain and fish from contaminated lakes to reduce risks of methylmercury exposure (PHIME, 2011).
- Reduced emissions of Lead are often described as a risk management success story with dramatically lowered general population exposure since the abolition of lead from petrol. Unfortunately, recent research reveals that adverse effects on children's cognitive "(IQ)" function and behaviour are found at much lower lead exposure levels than was previously known. Also effects on risk of hypertension in adults have been suggested. Therefore international bodies such as the US National Toxicology programme, The European Food Safety Authority (EFSA) and the WHO/FAO have recently revised their recommendations regarding intake of lead.

- For POP, as well as for organic contaminants in general, associations between environmental exposures and adverse health outcomes are difficult to quantify for a variety of reasons, including complex mechanisms, a multitude of potential sources for exposures and lack of knowledge of effects of mixtures. Nevertheless, concern about exposure and health effects has led to a number of international actions such as the WHO International Programme on Chemical Safety (WHO, 2013) and the UNEP Strategic Approach to International Chemicals Management (SAICM, 2013). For some substance groups, specific health effects have been identified such as dioxins (reproductive and developmental disorders, immune system damage and cancer) and PAH (cancer). The majority of the POPs listed in the Stockholm Convention are known to be endocrine disrupting chemicals (WHO/UNEP, 2012).
- For both HM and POP, human and ecosystem exposures occur via a number of pathways including direct contact with chemical-containing products, exposure in the indoor environment, and exposure from the far-field environment through air, water and food. Science-based policies aimed at reducing exposure need to consider all relevant exposure pathways. Atmospheric emissions and long range transport contribute in varying degrees to the exposure either directly or indirectly (e.g. via uptake in food chains in remote areas). The concern for health effects caused by HM and POP, warrants further policy action to reduce atmospheric emissions and long-range transport. It is very important to acquire good quality data and develop effective models to inform international policy and management actions for HM and POP and to assess the effectiveness of these policies and actions.

3.6.2 Short term priorities for actions on HM and POP

The HM and POP protocols under CLRTAP were signed in 1998 and were amended in 2009 (POP) and 2012 (HM). There are some outstanding issues from the revision of the HM protocol, i.e. setting requirements for mercury-containing products and specific emission limit values for HM from industrial sources that will be addressed at EB. At present there are no plans for further amendments of these protocols and parties should be encouraged to ratify the amended protocols on HM and POPs.

Specifically within the activities of the CLRTAP there is a great need for increased engagement and cooperation with the EECCA countries to

support development of emission inventories, monitoring and modelling. Cooperation with EECCA countries should be improved on both the scientific and policy levels.

The Executive Bureau (EB) of the CLRTAP should make use of monitoring and modelling results on HM and POP to demonstrate the achievements of the HM and POP protocols. These results can be used to encourage further ratification of the convention and to illustrate the potential benefits of further action. The role played by the integrated scientific approach that combines emissions estimation, monitoring, modelling should be highlighted since it has the potential to allow progress to be charted, and to identify areas for improvement.

Priorities for further policy actions for HM are:

- Establish emission limit values for individual heavy metals.
- Capping mercury emissions to avoid increase in total emissions due to increased activity or appearance of new sources (i.e. even if emission limit values are met at individual sources).
- Further regulation of products containing HM.
- Short term priorities for further policy actions on POP are:
  a) Initiate a process to enhance the synergies and cooperation between the CLRTAP and the Stockholm Convention and other international conventions, programs and policies.

3.6.3 CLRTAP HM and POP protocols in relation to other international conventions, policies and programs

Selected POPs are currently regulated under the UNEP Stockholm Convention on POPs and a new global convention on mercury, the Minamata Convention, will be signed in October 2013. HM and chemicals are also directly or indirectly regulated or monitored in various other international, EU-level and national legislations including the Basel and Rotterdam conventions, various EU directives on products, waste and industrial emissions and REACH. HM and PAH are also included in the EU Air Quality Daughter directive.

There are therefore overlapping policy frameworks that control the use and emissions of HM and POP and the future of CLRTAP work on these substance groups should be planned in relation to this.

In addition to policy frameworks, large efforts on monitoring and assessment are made under international programs such as the Arctic Monitoring and Assessment Programme under the Arctic Council. POP and HM are also in focus in regional sea conventions such as HELCOM and OSPAR.

The unique characteristics of CLRTAP among the various international conventions and programs are the strong links between science and policy and the integrated approach with an organizational system and expertise to develop emission inventories, monitoring programs, modelling activities and impact assessment on an international scale. CLRTAP can thus provide substantial support to other international conventions and programs focussed on either regulation or monitoring and assessment. CLRTAP can provide scientific assessments of abatement options for compounds restricted or banned under other conventions and agreements. Implementation of CLRTAP provides a mechanism by which parties can meet many of their obligations to other international agreements.

CLRTAP is the primary regional convention addressing air pollution by lead, cadmium and PAH and provides an international framework for research on these substances that could support possible future global work and the development of synergies.

Our recommendation is thus that CLRTAP should initiate cooperation with other conventions and programs working on different aspects of POPs and HM e.g. Stockholm Convention, Arctic Council/AMAP, Minamata Convention. An important part of this initiative is to evaluate and communicate the potentials for synergies and benefits in activities for a wide range of POP, HM and chemical contaminants in general.

A specific aspect is the benefits resulting from good monitoring and modelling practices as have been developed under e.g. CLRTAP, AMAP, OSPAR, HELCOM and proven useful to define and achieve environmental and public health objectives. Furthermore, joint efforts between international conventions and programs should promote ways to increase data sharing also with independent research activities e.g. by establishing routines for data storage in designated repositories.

As a first step, a strategic workshop on POPs focusing on enhancing synergies on e.g:

- Data storage, sharing and reporting.
- Ecosystem and human health effects.
- Monitoring and modelling.
- Identification of emerging chemicals of concern.

As a second step, a strategic workshop on Hg focusing on cooperation and enhancing synergies with the Minamata convention.

An additional issue to discuss is the funding of activities carried out by CLRTAP since the current protocols do not include funding arrangements for activities outside the scope of CLRTAP.

With a broadened perspective on chemical contaminants, it is also relevant to explore if legislation such as the EU REACH directive can be a driving force in efforts to combat environmental contamination of Persistent Toxic Substances (PTS).

CLRTAP can make significant contributions to the global assessment, management and governance of HM and POP and should initiate cooperation with other international conventions and programs.

3.6.4 Scientific Priorities for future work on HM and POP in CLRTAP

There is a need for an improved understanding of emissions, long range transport and exposure of HM and POP to allow for a systematic identification of risks and for evaluation of options for emission control. An integrated approach is necessary to exploit synergies in research i.e. including emissions, modelling and monitoring as well as impact assessment.

Some prioritised areas for development are:

- Promote development of alternative methods for emission inventories for POPs. Current inventories are not complete and lack of emission data is a large source of uncertainty in modelling and assessment. Methodologies applied for air pollutants (i.e. based on activity data and emission factors for individual sources and compounds) cannot be applied for many POPs, and may not be the most effective approach even when they are applicable. New approaches based on either a combination of monitoring and modelling at regional and local scales, or on substance flow analyses, should continue to be developed, and incorporated into emission inventories. In addition, historical emission data and models are needed to be able to take into account re-emissions of POPs and mercury.
- Promote data sharing between CLRTAP monitoring programs and external research projects (i.e. short-term or project data) by developing data management and QA/QC procedures that build on existing systems. Original data from monitoring, modelling, and emission inventories should be stored in agreed formats on an effective distributed network of interoperative locations. Additional data sources can be linked through meta data specifications.
- Stimulate an increase of national and EU research funding directed at relevant issues for CLRTAP.

- Stimulate an increase of funding for research and implementation for cooperation with non OECD countries in cooperation with e.g. UNEP, GEF, SAICM.
- Improve the scientific basis for identifying potential new POPs from among chemicals in commerce using high throughput screening methods that rely upon quantitative structure property relationships and target- and non-target chemical analysis.

3.6.5 Organisational issues

Contrary to the proposals contained in the document presented at WGSR 2013 (EB/Air/WG.5/2013/1) (Para 53), future work on heavy metals and POPs should be maintained and targeted as priority issues (EB).

Form an ad-hoc group with representatives for WGE, EMEP, WGSR to enhance cooperation and synergies on POPs and HM with other conventions, programs and policies (EB).

Promote the CLRTAP work on HM and POPs among parties to secure financing and maintain relevant networks of policy and science experts under the convention. The ambition level of continued work on POP should be balanced between consolidating the current protocols and adding new substances.

3.6.6 References

PHIME (2011) Effects of exposure to metals: No margin of safety in Europe! Project summary available at:www.med.lu.se/labmedlund/amm/forskning/haelsorisker_av_metaller/phime.

SAICM (2013) www.saicm.org/index.php?option=com_content&view=article&id=71&Itemid=473

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WHO (2013). http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality/activities/health-aspects-of-air-pollution-and-review-of-eu-policies-the-revihaap-and-hrapie-projects

WHO/UNEP (2012). http://unep.org/pdf/9789241505031_eng.pdf

Additional information on HM and POP can be found in the presentations made in the plenary session at the workshop:

McLeod (2013): http://www.saltsjobaden5.ivl.se/download/18.439d807113f821c98c538b/1372672231840/MacLeod_SaltsjobadenV.pdf

Kraus (2013): http://www.saltsjobaden5.ivl.se/download/18.439d807113f821c98c534a/1372666627982/Kraus_SaltsjobadenV.pdf

3.7 WG 7: Mid-term policies for Europe and its vicinity

Chairs: *Andrew Kelly* and *Scott Brockett*

Participants: *Helen ApSimon*, *Richard Ballaman*, *Leif Bernergård*, *Hester de Boer*, *Anna Gran*, *Carlijn Hendriks*, *Johanna Janson*, *Karin Klingspor*, *Emilia Konopka*, *Carsten Larsen*, *Steven Lauwereins*, *Lars Lundin*, *Krystztof Olendrzynski*, *Simone Schucht*, *Danguole Suziedelyte*, *Cecilia Svensson*, *Mar Viana*, *Marion Wichmann-Fiebig*, *Martin Williams*, *Roald Wolters*, *Christer Ågren*, *Eli Marie Åsen*, *Stefan Åström*

3.7.1 Conclusions and recommendations

- Ambient air quality controls: how to reflect the latest science without flip-flopping on what you control?
  a) Keep PM2.5 as main ambient control parameter.
  b) Address Black Carbon, primary combustion through soft text/source control
- Emissions from motor vehicles:
  a) Euro 6 should be key priority – EU Member States should become actively involved in test cycle discussions
  b) Non-exhaust emissions are of increasing concern – The approach may be product standards/abatement?
- Timing – which year should the Thematic Strategy be directed to?
  a) Binding NEC ceilings for 2025 with regular interim review of progress
  b) Option to trigger infringements if badly off track
- Scope for national/local action:
  a) EU legislation can tackle new product sources (Euro standards, Ecodesign, Non Road Mobile Machinery).
  b) For Member States/local level to tackle existing sources (fuel switching, retrofit, replacement incentives).
- Capacity-building and information infrastructure
  a) Require effect (ecosystem) monitoring under the NECD.
  b) Target proposals to available funding sources (e.g. LIFE, Horizon 2020, Structural Funds).

3.7.2 Principal recommendations

- Level of Ambition:
  a) First step based on available technical potential (75% gap closure by 2025).
  b) Second step based on structural change (building on climate and energy package to move towards long-term zero impact by 2030).
  c) Led initially by Commission, subsequently EU legislating institutions 2013 for first step proposal, c 2020 for second step
  d) To get close to long-term objective by 2030.
- Communication Prioritisation:
  a) Professional communication of AQ issues.
  b) All groups involved in air quality management [LRTAP Communication Group]
- As soon as possible:
  a) To change public perception of air quality, make adverse AQ impacts a reputational risk for industry, and so change the political context for regulation.

Sammanfattning

Denna rapport är en sammanfattning av resultaten från en internationell workshop kring framtida strategier för luftföroreningar som hölls i Göteborg 24–26 juni 2013. Workshopen är den femte i en serie som organiserats under rubriken ”Saltsjöbaden workshops,” där den första hölls i Saltsjöbaden i april 2000. Mötena har haft som övergripande tema att diskutera internationella luftvårdsfrågor, speciellt de som är av gränsöverskridande natur. Resultaten har sedan utgjort underlag för fortsatt arbete inom internationella organ, framför allt inom UN ECES arbete med konventionen kring långväga gränsöverskridande luftföroreningar (CLRTAP) och EU-kommissionen. Mötena har samlat beslutsfattare, forskare och experter inom området och de har kommit att utgöra en plattform där nya idéer och koncept kunnat diskuteras informellt.

Den workshop som presenteras i denna rapport organiserades av Naturvårsverket och IVL Svenska Miljöinstitutet i nära samarbete med CLRTAP och EU-kommissionen, The Global Atmospheric Pollution Forum och Nordiska Ministerrådet. Workshopen samlade cirka 130 beslutsfattare, forskare och experter inom området luftföroreningar, deras effekter och åtgärder.

En programkommitté (se Annex A) medverkade vid den övergripande planeringen, särskilt vid valet av ämnen och för den slutliga sammanställningen av slutsatser och rekommendationer.

Workshopen utformades på samma sätt som de tidigare med en inledande plenarsession, där de aktuella ämnesområdena presenterades, följt av diskussioner i arbetsgrupper som ledde fram till slutsatser och rekommendationer för respektiveområde. Slutligen presenterades dessa i en gemensam session, där man också enades om en serie gemensamma slutsatser och rekommendationer.

Denna rapport innehåller de allmänna slutsatserna liksom rapporterna från var och en av mötets sju arbetsgrupper. Föredragen som hölls under de gemensamma sessionerna återfinns på mötets hemsida; http://www.saltsjobaden5.ivl.se/. Förkortningsnyckel återfinns i Annex C.

Workshopen finansierades av Naturvårsverket, Nordiska Ministerrådet och Mistra. Vi som organisatörer vill uttrycka vårt stora tack för det ekonomiska stöd som gjort genomförandet av ”Saltsjöbaden V” möjligt.

Ytterligare information kring workshopen finns på http://www.saltsjobaden5.ivl.se, där också rapporter från tidigare workshops återfinns. För frågor och ytterligare information, vänligen kontakta Peringe Grennfelt (peringe.grennfelt@ivl.se), Anna Engleryd (anna.engleryd@naturvardsverket.se), John Munthe (john.munthe@ivl.se) eller Ulrika Håård, (ulrika.haard@ivl.se).

4. Annex A
Programme committee

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Young Micheal, Ireland
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5. Annex B
Workshop programme

Monday – June 24, 2013

10.30 Registration

13.00 Opening of the workshop

Welcome Anna Engleryd Swedish EPA

Opening speech Ambassador Annika Markovic, Department of Environment, Sweden

Plenary presentations

Session 1

Anna Engleryd, Chair

Beyond present air pollution and climate change policies, Markus Amann, IIASA.

Future role and challenges for CLRTAP, Martin Williams, CLRTAP.

Medium and long-term challenges and role for the EU – looking beyond the present air policy review, Thomas Verheye, European Commission.

14.50–15.30 Coffee break

15.30 Session 2

Peringe Grennfelt, Chair

- *Future effects-based air pollution control strategies – the needs for new approaches*
  Anne-Christine LeGall, Ineris, France.
- *Nitrogen out of the bottle: challenges to manage the genie*
  Jan Willem Erisman, Louis Bolk Institute, the Netherlands
- *Health Effects of Ambient Air Pollution: Scientific and Policy Challenges in dealing with Complex Mixtures*
  Annette Peters, Helmholtz Zentrum München, German Research Center for Environmental Health
- *Urban air pollution: Scope for local actions and linkages to the EU air and climate policies*
  Martin Lutz, Senate Department for Health, Germany

- *The Global Air Pollution Challenge: How can science support air quality management from local to hemispheric scales?*
  Frank Dentener, JRC

19.00 Reception and buffet dinner

Tuesday – June 25, 2013

08.30 Session 3

John Munthe, Chair

- *Science and regulation to support international cooperation on heavy metals*
  Katja Kraus, UBA, Germany
- *Science to support cooperative international regulations on POPs*
  Matthew MacLeod, Stockholm University

09.40 Preparation for Working Groups

10.00 Working Groups (Coffee/tea, fruit and sandwich will be available from 10.00–10.30)

12.30–13.30 Lunch

13.30 Working Groups (Coffee/tea, fruit and sandwich will be available between 14.45–15.30)

18.30 Evening cruise in the archipelago with M/S S:t Erik.

Wednesday – June 26, 2013

Kimber Scavo, Chair

09.00 Reports from Workning Groups

11.00–11.30 Coffee break

11.30 Conclusions from the workshop
Rob Maas, RIVM

12.30 Closure of the workshop
Richard Ballaman, BAFU

13.00 Lunch

6. Annex C Abbreviations

AMAP	Arctic Monitoring and Assessment Programme, a working group under the Arctic Council
CCAC	The Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants
CCC	Chemical Co-ordinating Centre (EMEP)
CEC	European Commission
CLRTAP	Convention on Long-Range Transboundary Air Pollution
EB	Executive Body of CLRTAP
EEA	European Environment Agency
EECCA	Eastern Europe, Caucasus and Central Asia
EGTEI	Expert Group on Techno-Economic Issues (CLRTAP)
EMEP	European Monitoring and Evaluation Programme
FAO	The Food and Agriculture Organization (UN)
FP7	The Seventh Research Framework Programme (CEC)
GAINS	Greenhouse Gas and Air Pollution Interactions and Synergies (IIASA integrated assessment model)
GAP Forum	Global Atmospheric Pollution Forum
HM	Heavy metals
Horizon 2020	The EU Framework Programme for Research and Innovation 2014–2020
ICPs	International Cooperative Programmes under WGE
ICP M&M	The International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends
ILC	The International Law Commission, established by the UN
INI	International Nitrogen Initiative
IPCC	Intergovernmental Panel on Climate Change
LIFE	The EU's financial instrument supporting environmental and nature conservation projects

Natura 2000	An EU-wide network of nature protection areas established under the EU Habitats Directive
PM	Particulate Matter
POP	Persistent Organic Pollutants
TFEIP	Task Force on Emission Inventories and Projections (CLRTAP)
TFH	Task Force on Health under WGE
TFHTAP	Task Force on Hemispheric Transport of Air Pollution (CLRTAP)
TFIAM	Task Force on Integrated Assessment Modelling (CLRTAP)
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WGE	Working Group on Effects (CLRTAP)
WGSR	Working Group on Strategies and Review (CLRTAP)
WHO	World Health Organisation

7. Annex D
List of Participants

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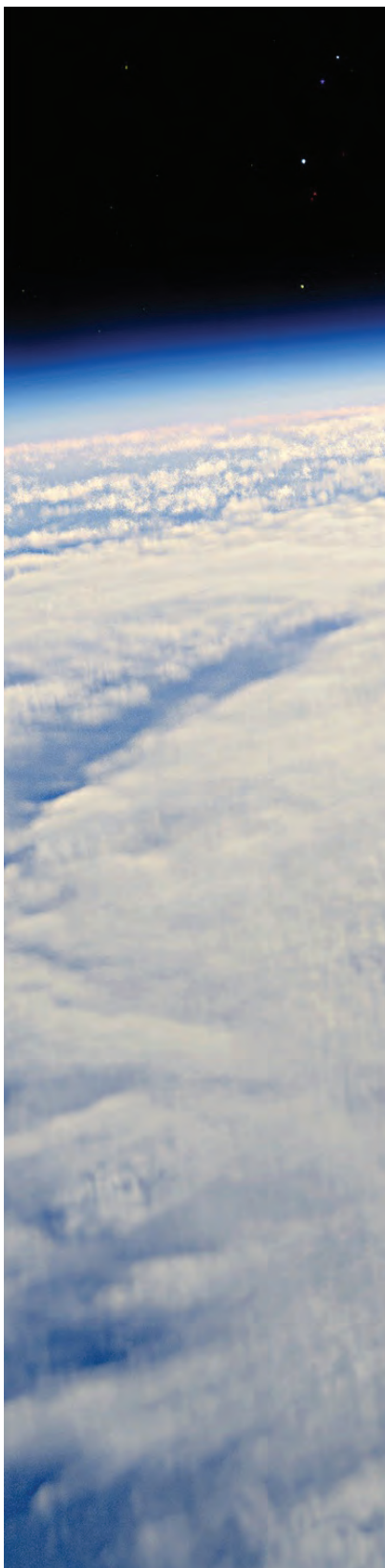
Saltsjöbaden V - Taking international air pollution policies into the future

24-–26 June 2013, 130 leading international policy makers, scientists, experts and others met at an international workshop in Gothenburg, Sweden, in order to discuss and outline future directions in air pollution science and policy. The workshop, which was organised in close collaboration with the Convention on Long-range Transboundary Air Pollution and the European Commission, involved several themes such as linkages to climate change including SLCP, nitrogen, global governance and effects to health and environment. The output is a series of recommendations for further actions with respect to effects to health, ecosystems and near-term climate actions. Recommendations were also given with respect to heavy metals and POPs. The recommendations are directed towards several international organisations and initiatives such as CLRTAP, European Commission, Climate and Clean Air Coalition and the Arctic Council.



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