Network for Environmental Risk Assessment and Management

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NERAM V: Strategic Policy Directions for Air Quality Risk Management

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Morris J. Wosk Centre for Dialogue
Simon Fraser University
Vancouver, B.C.

COLLOQUIUM STATEMENT

PREFACE

This Statement is the result of discussions held at the 2006 NERAM V *Colloquium "Strategic Policy Directions for Air Quality Risk Management*", the final meeting in the 5-year international Colloquium series convened by the University of Waterloo (Institute for Risk Research) and University of Ottawa (McLaughlin Centre for Population Health Risk Assessment), two nodes of the Network for Environmental Risk Assessment and Management (NERAM). The Colloquium was held in Vancouver, Canada at the Wosk Centre for Dialogue on October 16-18, 2006.

The Statement represents the collective thinking of more than 70 delegates including policymakers, regulators, public health groups, university researchers and other stakeholders from Canada, the UK, the US, Netherlands, Germany, Australia, New Zealand, Finland, and China (see Appendix for list of delegates). The Statement reflects the majority opinions expressed during two breakout sessions and the views of speakers and delegates expressed in plenary sessions. Delegates were asked to consider the following questions in their discussions:

- What do scientists know now that can translate into policy or program delivery solutions for air quality managers (i.e. interim outcomes/nuggets of wisdom for action now)?
- From the perspective of the practicing air quality manager, what are the most pressing research priorities to guide short term and long term air quality management strategies?
- Should we be moving towards international harmonization of air quality standards, emissions inventories, measurement? Should we think beyond air quality standards?
- How do we link air quality and climate change strategies? Where are the co-benefits and what are the disbenefits?
- Should there be further ongoing efforts to link the air quality management science, stakeholder and policy communities after NERAM? Is there a need for an independent forum to tease out nuggets of wisdom from science for those who are seeking air quality management solutions?

Draft versions of the Statement were vetted by the planning committee and delegates following the conference to produce this final version. All comments were editorial in nature and are not listed here.

STATEMENT SUMMARY

Current State of Science

1. A diverse and growing range of scientific evidence demonstrates significant effects of air pollution on human health and the environment, thereby justifying continued local and global efforts to reduce exposures.

Communication of Science of Policy Decisions

2. Communication of the evidence on the health effects of air pollution and the benefits of control is critical to enhancing public awareness and demand for policy solutions. Novel approaches are needed for interpretation of scientific evidence to guide air quality managers in formulating local programs and policies.

3. A clearer articulation of the physical and policy linkages between air quality and climate change is needed to inform public opinion and influence policymakers. Care must be taken not to compromise air quality through actions to mitigate climate change. Similarly, air quality solutions must be reviewed in terms of impacts on climate.

Policy Approaches for Air Quality Management

4. Improving air quality is best approached at a systems level with multiple points of intervention. Policy solutions at the local, regional and international scale through cross-sectoral policies in energy, environment, climate, transport, agriculture and health will be more effective than individual single-sector policies.

5. Ambient air quality standards based on exposure-response relationships continue to serve as a basis for air quality management for non-threshold pollutants such as PM. Interim targets set by WHO-Europe in 2006 provide achievable transitional air quality management milestones for parts of the world where pollution is high as progress is made towards reaching long-term air quality goals.

6. Air quality management driven solely by air quality standards may not be optimal for non-threshold pollutants in areas where standards have already been attained or for "hot spots" where measures to achieve further air pollution reductions can be increasingly difficult and costly. Exposure reduction and continuous improvement policies are important extensions to ambient air quality standards.

7. Given economic growth projections, hemispheric transport of pollutants from Asian countries will continue to be a significant contributor to poor air quality globally. International scientific and technical collaboration to assess air quality and assist in controlling emissions, while enabling economic growth is critical.

8. The health effects literature suggests that reducing exposure to combustion-generated particles should be a priority. This includes emission reduction measures related to fossil fuels and biomass. The evidence is sufficient to justify policies to reduce traffic exposures, especially if such policies serve to address other societal problems such as 'grid lock', increasing commute times and distances, and obesity.

9. Prioritization of pollutants and sources for emission reduction based on the potential for exposure may be a useful alternative to rankings based on emission mass. The intake fraction concept assigns more weight to emissions that have a greater potential to be inhaled and therefore to impact health.

10. Air quality management strategies focused on improving visibility may gain greater support from the public and policymakers than those oriented strictly towards the improvement of public health.

11. International harmonization of air pollutant measurements and metrics, emission inventories, modeling tools, assessment of health effects literature and health-related guidelines are needed for efficient policy implementation.

Science and Policy Assessment Needs

12. A major scientific challenge is to advance understanding of the toxicity-determining characteristics of particulate matter (composition, size and morphology, including surface chemistry) as well as the role of gaseous co-pollutants to guide the development of source-specific air quality management strategies.

13. The effectiveness of local, regional and global policy measures must be scientifically evaluated to confirm that the expected benefits of interventions on air quality, human health and the environment are achieved and if not, that alternate measures are implemented quickly.

Elaboration of Summary Statements

Current State of Science – Do We Know Enough to Act?

Scientific evidence of the effects of air pollutant exposure on human health and on the environment is strong enough to justify global efforts to continue to reduce outdoor concentrations, even in locations that meet air pollutant standards. Ambient particulate matter, which has received the most attention in recent years, is linked to a number of different health outcomes, ranging from acute changes in the respiratory tract, including inflammation and impaired pulmonary function, through to increased risk of symptoms requiring emergency room or hospital treatment, and to increased risk of death from cardiovascular disease and lung cancer. This evidence stems from studies of both acute and chronic exposure. Toxicological and human clinical studies support the epidemiological findings.

Communication of Science for Policy Decisions

The current state of knowledge on the health and ecological effects of air pollution is not broadly communicated nor understood. Clear messaging from health effects scientists to the public and policymakers that conveys the full breadth of the evidence and true extent of scientific consensus is needed. Scientific information should be readily available, particularly for politicians and local planners who are motivated to implement evidence-based solutions and/or make decisions that will benefit public health over the short and long term. For example, a comprehensive plain language fact sheet summarizing what is known, as a basis for policy interventions, as well as examples of practical solutions, would be useful. Comparative risk assessments, such as the WHO Global Burden of Disease project[1] findings, may provide a useful format for conveying the public health significance of air pollution exposures in context with other environmental health risks.

Given the extensive literature on various aspects of air quality management, it is important to have a diverse range of processes to assess and communicate the policy significance of scientific knowledge to local, regional, national, and international policymakers. Reputable experts who specialize in articulating the science-policy interface are important to identify and their role needs to be recognized and supported. Organizations and groups such as World Health Organization (WHO), Clean Air for Europe (CAFE), NARSTO, and the UK Air Quality Expert Group serve this function well at the international and national level. Exposure reduction actions can be most effective when designed at the local level and thus, there is a need for expertise to translate the scientific information for development of practical, cost-effective local level air quality management policies. Ideally, local level "science-policy" integration working groups would be established including representation from the private sector and other local stakeholders. For example, the British Columbia Ministry of Environment has informally convened local university air quality researchers, BC Lung Association and others to provide guidance on the implications of science for local level policies and programs.

[1]Ezzati et al. 2006. Chapter 4. Comparative Quantification of Mortality and Burden of Disease Attributable to Selected Risk Factors. In Lopez et al. Global Burden of Disease and Risk Factors. The World Bank and Oxford University Press. New York, NY. http://files.dcp2.org/pdf/GBD/GBD04.pdf.

Policy Approaches for Air Quality Management

Health-based Air Quality Standards and Guidelines

Ambient air quality standards based on exposure-response relationships continue to serve as the primary foundation for air quality management for non-threshold pollutants such as particulate matter. In low and middle income countries where air pollution levels are the highest, interim targets, as suggested by WHO-Europe, aim to limit the absolute maximum level of individual risk and provide a benchmark for progress in reducing population exposures. The 2006 global update of the World Health Organization guidelines for air quality[2] has recommended guidelines for PM expressed as a concentration and averaging time, together with a series of three successively more stringent 'Interim Targets". This approach is deemed by the WHO as particularly helpful for developing countries whose levels of PM greatly exceed the ultimate air quality guidelines.

Exposure Reduction Targets

Air quality management driven only towards the achievement of air quality standards may not be optimal in areas where standards have already been attained or in "hot spots" such as high traffic areas, where measures to achieve further air pollution reductions can be increasingly difficult and costly.[3] To make further public health gains in these areas exposure reduction and/or continuous improvement policies are an important addition to health-based ambient air quality standards. The European Commission has proposed a new exposure reduction target (ERT) concept for fine particulate matter $PM_{2.5}$, recognizing the benefits of continued reductions in pollutant levels even in relatively "clean" areas.[4] The exposure reduction concept promotes a reduction in exposures of a larger part of the population, whereas the limit value approach may only affect a smaller number of people as compliance is attained. Therefore greater overall improvements in public health could be expected at a lower cost through ERT, however new approaches to monitoring or tracking progress may be needed to ensure exposures decrease.

Hemispheric Transport

Given economic growth projections, emissions from sources in Asia need to be considered both in terms of their implications for North America, but more so for air quality in Asia. Continued international collaborative efforts to assess emissions sources and translate worldwide research findings into practical solutions are required to improve air quality in Asia and other countries.

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[2] WHO, 2006. Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global Update 2005. Summary of Risk Assessment. http://www.euro.who.int/air/activities/20050222_2

[3] Maynard, R. 2003. Scientific information needs for regulatory decision making. J Toxicol Environ Health. Part A. 66:1499-1501.

[4] See further discussion in Chapter 5 of the Guidance Document.

Risk-Based Exposure Reduction

While there are still uncertainties in the science to guide source-specific air quality management strategies, the health effects literature suggests that strategies to reduce exposure to combustion-generated particles should be a priority. This includes carbonaceous sources such as emissions from coal-fired power plants, as well as wood burning sources.

There is growing evidence to indicate that exposures related to proximity to traffic are responsible for a broad range of health effects ranging from allergic sensitization, asthma, cancer, and cardiovascular events. While technological measures to reduce the overall emissions from transportation will continue to be necessary given projected increases in vehicles and vehicle miles traveled, broad-based measures to reduce the population's overall time spent near or in traffic can be expected to have multiple public health and quality of life benefits. Thus, such measures need to be included in all urban planning exercises.

In assessing which of the myriad of air pollutant sources needs to be more closely considered for emission reductions, the 'intake fraction' approach is a useful alternative to rankings based on mass emissions. This approach assigns more weight to emissions that have a greater potential to be inhaled and thereby provide a more health-effect oriented ranking of the sources under consideration for control. Intake fraction reflects relative exposures due to plume rise, dilution, meteorology and population density. Car and truck emissions, for example, rank very low based on $PM_{2.5}$ mass emissions compared to road dust and waste burning sources, but rank high in an exposure-based ranking.[5]

Systems-level Risk Management

Poor air quality is best approached as a systems-level problem requiring multiple points of intervention. Policymakers must recognize that solutions directed simultaneously at the local, regional and international scale through cross-sectoral policies in energy, environment, climate, transport, agriculture and health will be more effective than individual single-sector policies. The assessment of impacts and development of solutions to improve not only human health, but also ecological sustainability are consistent with a systems level approach. For example, anthropogenic sources of air pollution as well as non-anthropogenic sources such as methane stores in Arctic permafrost need to be considered.

Win-win strategies addressing multiple air issues (air quality, climate change, noise, visibility) can be identified based on existing knowledge. For example, reducing traffic exposures through dedicated bike paths, land use and transportation planning, and cleaner fuels policies can offer multiple benefits, including improved air quality, reduced greenhouse gas emissions, reduced noise, improved visibility, and reduced obesity.

Sustainable energy system solutions such as district based co-generation providing combined thermal and electricity are an example of a cost-effective systems-level strategy with benefits for sustainable energy, air quality, climate change and health. The State of California provides

[5] Croes, B. 2006. Policy Case Studies from North America. Presentation at NERAM V October 17, 2006. http://www.irr-neram.ca/about/Colloquium.html

leadership in integrated air quality, climate change and energy policy solutions through measures to reduce greenhouse gas emissions from cars and light trucks and stationary sources, requirements for purchases of clean electricity, renewable energy source targets (20% from renewable energy sources by 2010), incentives for energy efficiency and conservation programs.

Tools that are accessible to local air quality managers to assist in making integrated policy decisions focusing on achieving ecological sustainability and expected health impacts at an overall level of population health are needed.

A paradigm shift is needed to focus more broadly on achieving sustainability objectives by driving choices and behaviours of the public. Social marketing efforts are important in mobilizing public demand for solutions and political will to take action.

A clearer articulation of the linkage between air quality and climate is needed to mobilize the public and influence policymakers. Care must be taken not to compromise air quality through actions to mitigate climate change. Similarly, air quality solutions must be reviewed in terms of impacts on climate change.

Visibility as a Policy Driver

Air pollution typically causes a white, yellow, or brown haze that reduces visual range and affects the public's ability to enjoy their surroundings. The concept of visibility (or impaired visibility due to haze or smog) as an approach to communicate to governments, legislators, the media and the public the linkage between air pollution concentrations, environmental degradation, and health costs has been used in Hong Kong and elsewhere. Four levels of air quality (poor, better, good, average) are defined based on general and roadside concentrations of PM_{10}, NO_2 and SO_2 and levels of visibility. The public often uses the clearness of the outdoors as a general measure of air quality. Therefore, air quality management strategies developed and communicated with the goal of improving visibility may find greater support from the public and policymakers than those oriented strictly towards improvement of public health as the main policy driver.

Directions for Harmonization

Reduction of exposures to air pollution and continuous improvement in air quality are required at a global level. International harmonization of air pollutant measurements and metrics, emission inventories, assessment of health effects literature and health-related guidelines are recommended. Policy decisions related to setting air quality standards and management strategies however need to be made at the local level considering characteristics of the local and regional airsheds, sources, and social and economic considerations.

Science and Policy Assessment Needs

A major scientific challenge is to characterize the health effects of complex mixtures in the atmosphere. Studies are needed to understand the toxic characteristics of particulate matter (chemistry, compositions and size), as well as the role of gaseous co-pollutant, to guide the development of source-specific air quality management strategies. The effects of various reduction technologies on the chemical and size relationships of PM needs to be better understood so that potential dis-benefits are avoided.

The effectiveness of local, regional and global air policies needs to be formally evaluated to understand the actual and measurable impacts/benefits of interventions at various scales on air quality, human health and the environment. Thus, monitoring and surveillance programs of emissions and ambient air quality must be preserved, planned and dedicated to continuous policy performance review. Effective local air quality management initiatives may be a guide to what may be done more regionally and globally. Evaluation should be ongoing and iterative so that policy measures can be refined based on measurable performance criteria. Ideally, this should include attempts to track improvement in health and/or the environment to ensure the ultimate objectives are being achieved to greatest extent possible given the public investments in control measures.

Measures of public health burden need to broadened beyond mortality alone to include indicators of illness and impacts on quality of life and subsequently, approaches to include and appropriately weight such quantitative information in the evaluation of policy options need to be developed.

Additional contaminants (POPs, metals) and ecosystem impacts should also be assessed and approaches to include and appropriately weight such quantitative information in the evaluation of policy options need to be developed.

APPENDIX – LIST OF DELEGATES

Name	**Organization**
Ryan Allen	*Simon Fraser University, Burnaby BC*
Jane Barton	*Environment Canada, Gatineau QC*
Alex Basiji	*Health Canada, Toronto ON*
Paul Baynham	*Northland Regional Council, Whangarei, New Zealand*
Richard Bennett	*Ministry of Environment, Victoria BC*
Carmelita Biagtan	*BC Lung Association, Vancouver BC*
Maryse Bouchard	*Institut national de santé publique du Québec, Montréal QC*
Michael Brauer	*University of British Columbia, Vancouver BC*
David Briggs	*Imperial College London, London, U.K.*
Jeffrey Brook	*Environment Canada, Toronto ON*
Christina Cheng	*Ontario Ministry of the Environment, Etobicoke ON*
Quentin Chiotti	*Pollution Probe, Toronto ON*
Anthony Clarke-Sturman	*Shell International Oil Products, London, U.K.*
Aaron Cohen	*Health Effects Institute, Boston MA*
Ray Copes	*BC Centre for Disease Control, Vancouver BC*
Lorraine Craig	*University of Waterloo, Waterloo ON*
Bart Croes	*California Air Resources Board, Sacramento CA*
Hadi Dowlatabadi	*University of British Columbia, Vancouver BC*
Louis Drouin	*Montreal Public Health, Montreal QC*
Ali Ergudenler	*Greater Vancouver Regional District, Burnaby BC*
Long Fu	*Alberta Environment, Edmonton AB*
Maria Furberg	*RWDI AIR Inc., Vancouver BC*
Larry Gephart	*ExxonMobile Biomedical Sciences, Annandale, NJ*
Scott Giffin	*Public Health Services New Brunswick, Saint John NB*
Bruce Gillies	*Environment Canada, Toronto ON*
Stephanie Gower	*University of Waterloo, Waterloo ON*
Andrew Green	*Environment Canada, Vancouver BC*
Kong Ha	*Government of the Hong Kong SAR, Hong Kong, China*
Jamal Harb	*Health Canada, Burnaby BC*
Anthony Hedley	*University of Hong Kong, Hong Kong, China*
Steven Hilts	*Teck Cominco Metals Ltd., Trail BC*
Philip Hopke	*Clarkson University, Postdam NY*
Tracey Inkpen	*Environment Canada, Dartmouth NS*
Rand Jackson	*Natural Resources Canada, Ottawa ON*
Matti Jantunen	*National Public Health Institute of Finland, Kuopio, Finland*
Derek Jennejohn	*Greater Vancouver Regional District, Burnaby BC*
Sam Kacew	*University of Ottawa, Ottawa ON*
Bruce Kay	*Environment Canada, Vancouver BC*
Roger Keefe	*Imperial Oil Ltd., Calgary AB*
Hugh Kellas	*Greater Vancouver Regional District, Burnaby BC*
Norman King	*Montreal Public Health, Montreal QC*

Graham Kissack	*Catalyst Paper, Vancouver BC*
Tom Kosatsky	*Montreal Public Health, Montreal QC*
Dan Krewski	*University of Ottawa, Ottawa ON*
Alan Krupnick	*Resources for the Future, Washington DC*
Michal Krzyzanowski	*World Health Organization, Bonn, Germany*
Brian McLean	*USEPA, Washington DC*
Addy Mitchell	*University of Waterloo, Waterloo ON*
Curtis Moore	*Health & Clean Air Newsletter, McLean VA*
Jack Nickel	*Health Canada, Burnaby BC*
Marie O'Neill	*University of Michigan, Ann Arbor MI*
Glen Okrainetz	*Ministry of Environment, Victoria BC*
William Pennell	*NARSTO Management, Pasco WA*
Karla Poplawski	*University of Victoria, Victoria BC*
Franck Portalupi	*Environment Canada, Gatineau QC*
Kathy Preston	*RWDI AIR Inc., Vancouver BC*
Gloria Rachamin	*Ontario Ministry of Health, Toronto ON*
Michael Rensing	*Ministry of Environment, Victoria BC*
Nigel Routh	*Department of Environment & Conservation (NSW), Sydney, Australia*
Jonathan Samet	*Johns Hopkins Bloomberg School of Public Health, Baltimore MD*
Markus Schulze	*ThyssenKrupp Steel, Duisburg, Germany*
Eleanor Setton	*University of Victoria, Victoria BC*
John Shortreed	*University of Waterloo, Waterloo ON*
Adolfo Silva	*Canadian Petroleum Products Institute, Toronto ON*
Dean Stinson O'Gorman	*Environment Canada, Gatineau QC*
Brian Stocks	*Ontario Lung Association, Windsor ON*
Natalie Suzuki	*Ministry of Environment, Victoria BC*
Rob Taalman	*Shell International, The Hague, Netherlands*
Suzanne Therien	*University of Ottawa, Ottawa ON*
Annemoon van Erp	*Health Effects Institute, Boston MA*
Anton Van Heusden	*Environment Canada, Gatineau QC*
Cindy Walsh	*BC Ministry of Environment, Surrey BC*
Corinna Watt	*Environment Canada, Edmonton AB*
Martin Williams	*DEFRA, London U.K.*