Summary of Breakout Sessions

Models and Scenarios Group

Day 1

Facilitator and Reporter: Adam Wilson
University of New Hampshire
Scribe: Dorothy MacFarlane
New Brunswick Lung Association

Is there information missing from the background documents that should be added?

The following information was not included in the background document:

- effect of air quality on climate change
- identification of a common baseline (based on an air quality standard or particular year)
- the fact that a climate change policy has co-benefits of improved air quality, and thus additional benefits to health

It was recommended that discussion of the hierarchy of models should include separate air quality models which can then be used in an integrated assessment.

The two steps would include:

- use available techniques to estimate future air quality for location/region of interest and to obtain a baseline data set of air quality for this location that is compatible (in resolution and confidence)
- add the difference in air quality between baseline and predicted levels into an integrated model that determines change in exposure, change in health response frequency, and economic impacts.

What research or other work is needed to improve the models that are used to create scenarios for air pollution and health effects. List broad research areas that can be studied NOW.

Research needed to improve scenarios includes:

1) Use a regional climate model coupled with regional air quality data
   a) use air quality models with GCM or RCM outputs, then obtain the best available estimates of regional and urban scale air quality changes (using baseline defined in Q1)
   b) sub-grid urban exposure models (1-5 km resolution) are desirable for exposure estimates as opposed to 20-40 km resolution given by air quality models.
   c) coarse-scale model may bias the calculation of benefits

   d) need to identify the bias of coarse air quality monitoring on health and calculation of benefits
2) fine resolution may not be important
   a) may depend on nature of the pollutant that is being studied
   b) jump to finer scale may not guarantee better subsequent exposure and health benefit estimates
3) Develop better interfaces between models
   a) from global chemistry to regional to local/ neighborhood scale
4) Develop precise emission scenarios including: anthropogenic changes, population changes, technological changes, economic changes
   a) need to define scale of study (are global trends enough? are other scales more important?)
   b) need land-use scenarios (anthropogenic and natural) that feed into meteorology and emissions, with links to pollen (aerobiology) and photochemistry
5) Develop models that are accurate at smaller scales (more local accuracy) and can predict longer term changes (annual to decadal)
   a) barriers/difficulties: regional models are very complex; therefore require longer computer-running time

What scenarios should be modeled NOW to help estimate risk and to advise risk management options?

1) Recommended new scenarios include
   a) emission scenarios based on the use of new technologies that will be added to reduce emissions
   b) downscaled (global to regional) climate scenarios and atmospheric chemistry changes (assume Kyoto targets are met)
   c) scenarios to compute the benefits of Kyoto on Health (e.g. NA 2010 "least-cost scenario")

What is the research/knowledge capacity in this area? Please indicate approximate number of known researchers/experts and potential researchers/experts in Canada (in the US?).

Participants listed some individuals and organizations. Development of this list will continue after the meeting.

Cameron Wake, Adam Wilson, Tom Kelly- AIRMAP, University of New Hampshire
www.airmap.unh.edu
EPA Global Change Program
University of Michigan
Centre for Study of Human Dimensions of Global Change
Energy and Environment Centre
Superfund
Carnegie Mellon University
Meteorological Service of Canada, Downsview, Ontario
Jack McConnell, Diane Michelangelli
York Centre for Environmental Chemistry

Jim Sloane
University of Waterloo
Trevor Schultz, Arthur Lee
CEGIC, Mississauga, Ontario
McGill University
Alan Bertram
University of British Columbia

Before, during, or post-workshop, will participants provide names and contact information on other researchers in this field?

Answered together with question above.

Before, during or post workshop, will participants share literature lists with the network?

Not addressed.

Day 2

Facilitator and Reporter: Bill Appleby
Environment Canada
Scribe: Dorothy McFarlane
New Brunswick Lung Association

Identify areas of research interest for participants and, if possible, for other key researchers in this field.

Research areas of interest to participants:

1) development of health and cost benefit scenarios given the implementation of a variety of pollution control programs
   a) research/information needed
      i) emission models for pollutants
      ii) technological information
      iii) input from policy analyst
      iv) health impacts models, exposure models (Health Canada)
      v) cost models
2) scoping study to assess downscaling, ie. to statistically link GCM output to regional/ local air quality via airmass or synoptic categories
   a) methodology
   b) examine how Kalkstein airmass categories for selected cities relate to observed spatial grid of basic meteorological conditions (grid derived from climate data archives (NCEP)
      i) simultaneously study airmass category air quality characteristics
      ii) if link exists between spatial grid patterns in airmass category frequency and characteristics, then propose to predict future grid patterns from a GCM and

"downscale" to local air quality

3) detailed comments
   a) exposure bias exists due to air quality model resolution
   b) need to quantify the population rate of exposure on a coarse grid vs. a finer grid (on an annual basis) need a 5 km air quality model data set (models: MC2, MM5, GEM were run at a 2.5 km resolution last year.)
   c) need understanding of pollution deposition "hot spots", source deposits, downwind nature, problems with using automatic samplers.
   d) use GIS, include water quality information.
4) use air quality models with GCM or RCM outputs and obtain best available estimates of regional and urban scale air quality changes
   a) methodology
      i) assign population an exposure from 40 or 20 km resolution data and then with 1-5 km resolution data
      ii) compute the benefits/ increased risk for both groups in many locations since spatial distribution of people vs. the grid would have an impact - small/ random differences would imply that benefits could be computed using 20 km resolution data with no bias

Identify broad research projects that could be used to study prioritized areas from Breakout Session 1.

Identified above.

Identify researchers who could work on the above projects.

Guodong Sun, Carnegie Mellon University)
Jeff Brook, Environment Canada
Cameron Wake, University of New Hampshire

Identify who will take the lead to develop this research, either as individuals or teams.

Unanswered

Summary of Breakout Questions

Synergistic and Cascade Effects + Effects of Mitigation Combined Group

Day 1

These two breakout groups were merged into one breakout discussion due to the small number of people in the Effects of Mitigation group.

Facilitator and Reporter: Douglas Haines

Climate Change and Health Office, Health Canada
Scribes: Jill Boucher and Dean Searle
New Brunswick Lung Association

Is there information missing from the background documents that should be added?

No additional information was added to the background documents.

With respect to this topic, what research is needed to increase our understanding of the risk? List broad research areas that can be studied NOW.

The breakout group indicated the climate change, air pollution, and health research needs - in the broadest sense. The key research gaps/priorities included:

- With respect to outdoor environments
  - climate change and air pollution effects on morbidity (not just focusing on mortality)
  - long-term elevated air pollution and chronic health impacts vs.'episodal' pollution and health impacts
  - differential health impacts of climate change, air pollution, weather, and allergens
  - the impact of atmospher and pollution interactions on GHGs and climate change

- With respect to indoor environments
  - synergisms between biological and non-biological components of indoor air (VOCs, gas, mold, fungi, wood smoke, bacteria)
  - improved exposure assessments

- Outdoor and indoor interactive considerations
  - effects of climate change and air pollution on various occupational/ vulnerable groups (emergency responders such as firefighters, agricultural workers)
  - improved human health administrative data (health data not documented as well as weather data; need to expand capacity of databases)

- Synergistic effects of climate change on wildlife and agriculture with human health
  - effect of increased use of pesticides on air quality and human health
    - health impacts
    - socioeconomic* impacts for certain groups (ie. farmers)
      *note: link to other network - Climate Change and Socioeconomic Impacts Research Network
    - mechanisms to study synergistic/ cascade effects of heat, air pollution, and agricultural changes
    - use of animal or plant models for extrapolation to human health
  - *Not related to air pollution but was part of discussion*
    - *effects of climate change on availability and distribution of wild animals (hunted foods)*
    - *effects of climate change on quality and quantity of harvested foods*

note link to other networks:
Climate Change and Socioeconomic Impacts Research Network
Climate Change and Population Vulnerability Research Network
Climate Change and Extreme Weather Events Research Network

What research is needed to improve our management of this risk? List broad research areas that can be studied NOW.

Research is needed in the following areas to address the broader topics discussed during Q1.

• Outdoor environments
- improved assessments of population exposure and individual exposure levels
coordination of monitoring stations and study sites (now not in close proximity giving crude estimates of exposure assessments***)***
- improvement of exposure assessment tools, techniques, methods

• Indoor environments
- effects of changes to infrastructure and ventilation devices (placement of heat exchangers and vapour barriers) on indoor air quality
- better assessments of exposure to pollutants
- contribution of indoor pollution levels vs.outdoor pollution to morbidity and mortality rates

• Synergistic studies, outdoor and indoor environments

- Iitegrated indoor/outdoor exposure assessments
- participatory research focus (move away from expert model to getting community involved in the beginning)
- place-based studies (rural, urban, etc.)
- assessment of vulnerability of specific groups
    - occupational groups
    - children
    - elderly
    - impoverished
    - First Nations

Can we estimate (YES or NO) the level of this risk, ie. Serious-Moderate-Limited? If YES, please estimate risk level for health effects from exposure to heat/cold and air pollution, and exposure to pollen (and/or heat/air pollution).

Unanswered

What is the research capacity for these research areas? Please indicate approximate number of known researchers and potential researchers in Canada (in the US?).

For both indoor and outdoor research areas, the breakout group identified the following as

resources and researchers. The list will continue to be built after the workshop.

EnerGuide for Houses Program (nation-wide indoor air quality assessment databases)
Air Research Group, Health Canada
Statistics Canada (mortality admissions)
Canadian Institute for Health Information (CIHI)
Nova Scotia Environmental Health Centre (clinical)
Sir Wilfred Grenville College, Nfld. (Environmental Studies)
University of Toronto
McMaster University
University of Ottawa
Health Canada, Environment Canada, City of Toronto
(as participants in 4-city study_Heat, cold, pollutants/pollen/moulds on human mortality)

Before, during, or post-workshop, will participants provide names and contact information on other researchers in this field?

Unanswered

Before, during or post workshop, will participants share literature lists with the network?

Unanswered

Day 2

Facilitator: Douglas Haines
Climate Change and Health Office, Health Canada
Scribes: Jill Boucher and Dean Searle
New Brunswick Lung Association

Identify areas of research interest for participants and, if possible, for other key researchers in this field.

The breakout group listed 5 potential areas of research interest that included:
- Indoor Air Quality (IAQ) and Wood Combustion Studies
- Multi-City/ Regional Nested Studies of Weather/Climate Change/Air Pollution/Allergens
- Vulnerabilty Assessments
- Methodology (integrate spatial analysis into exposure assessments and epidemiological studies)
- Adaptation Science (communication of science to public and their perceptions of and behavioural responses to new scientific evidence, understand the effectiveness of interventions)

Identify broad research projects that could be used to study prioritized areas from Breakout Session 1.

The breakout group identified three broad projects out of the above 5 research areas.

- Indoor air quality (IAQ) and health effects
  - include effects of wood combustion
  - exposure assessments
  - outdoor air monitoring for wood combustion studies
  - housing characteristics including placement of vapour barriers, heat exchangers, levels of air pollutants (mould, dust, volatile organic compounds, wood smoke, fungi, gases)
  - linked to health data
  - feasibility of such a study, study scope, ethics, methods, etc. need exploration
  - investigate effectiveness of interventions for improving IAQ

- Multi-city/ regional nested studies of weather, climate change, air pollution, allergens
  - proportion of interactive exposures attributable to weather, allergens, air pollution, climate change
  - obtain daily city-wide hospital records
  - scan larger population/whole population- focusing on broader health outcomes (higher resolution of subtle impacts can be achieved with large population studies)
  - use smaller groups (e.g.K-6 children) for direct physiological tests (e.g. pulmonary function, spirometry)
  - longitudinal studies very valuable

- Vulnerability assessments
  - identify and assess vulnerable populations and health impacts of climate change and pollution (could cross-cut the above projects or stand as a distinct project)
  - include matrix for spatial comparisons of these areas
    - northern
    - coastal
    - rural
    - urban
  - incorporate transboundary air shed exposure
  - categories of vulnerable groups include
    - children
    - elderly
    - outdoor workers
    - homeless and impoverished
    - farmers
    - First Nations
    - ill people (pre-existing health conditions)

Identify researchers who could work on the above projects

The breakout group contributed several potential researchers and collaborators to each identified project and identified resources. Some people may be useful resources under more than one

project:

• Indoor Air Quality (IAQ) and health studies

Researchers/Collaborators:
Health Canada Air Research Groups
Mark Raizenne - Air Health Effects Division, Research Manager
David Stieb - Air Health Effects Division, A/Head
David Miller - Carleton University, Chemistry Professor (fungi)
Health Canada, Visiting Scientist
Virginia Salares - Canadian Mortgage and Housing Corporation
Senior Researcher, Project Officer
Audrey Smargiassi - Montreal Department of Public Health
Researcher, Toxicologist (pesticides, metals)
Robert Dales - Health Canada
Air Quality and Health Division
Norm Anderson - Maine Lung Association
Board Member
Alain Gosselin - Environment Canada
Air Issues and Toxics
Benoit Levesque - Researcher
Public Health Research Unit, Centre Hospitalier Universitaire de Québec
Nicholas Gilbert -
Kathleen Malloy - Natural Resources Canada
Tom Rand - Saint Mary's University
New Brunswick Lung Association

Resources:

Energuide for Houses Program and R2000 study results (Sara Peckford - Conservation Corps Newfoundland & Labrador - EcoTeam Director))
Statistics Canada
Canadian Institute for Health Information
Nova Scotia Environmental Health Centre

• Multi-city/ regional nested studies of weather, climate change, air pollution, allergens

Researchers:

Tom Kelly - University of New Hampshire - AIRMAP
Nancy Day - City of Toronto Public Health Department
Paul Comtois - University of Montreal
Associate Professor, Environmental Respiratory Health (asthma, allergies, "sick buildings")
David Richardson - St. Mary's University
Dean of Science (pollen)
Michelle Garneau- University of Montreal
Professor, Geography Department (pollen)

Robert Dales - Health Canada
Air Quality and Health Division
Shouquan (Chad) Cheng - Environment Canada
Climatologist/Meteorologist
Pierre Ernst - McGill University
Clinical Epidemiologist & Biostatistician
University of Toronto (general)
University of Ottawa (general)
Michael Jerrett - McMaster University
Assistant Professor School of Geography and Geology
Sir Wilfred Grenville College
Yvette Bonvalot - Director, Montreal Department of Public Health
Robert Beveridge - Brockville Hospital, Queen's University
Medical doctor
Gary Lines - Environment Canada
Climate Change Meteorologist
Robin Sears - McMaster University

Resources:

National Aerobiology Lab (Contact: Nancy or Frances Coates)
outdoor environmental databases
4 city study of weather, climate change, allergens, and pollutants and synergistic/differential health impacts - Vancouver, Montreal, Toronto, Windsor (contact Chad Cheng- Environment Canada, Climatologist/Meteorologist)

• Vulnerability assessments

Researchers:
Pierre Gosselin - Universite de Laval
Health Issues Research Network Coordinator (HIRNC) for Climate Change and Vulnerable Populations
Wendy Thompson - Health Canada, Research Analyst
Health Issues Research Network Coordinator (HIRNC) for Climate Change and Child Health

Tony Myres - Health Canada
Senior Science Advisor, Office of Children's Environmental Health
Canadian Institute for Child Health
Leanna Falkiner - Canadian Institute for Catastrophic Loss Reduction
Research Officer and Coordinator, Partner Relations
Health Issues Research Network Coordinator (HIRNC) for Extreme Weather Events.

Resources:

Health NGO's
Health Canada Centre for Healthy Human Development

Medical community, children's hospitals (e.g.,IWK)
First Nations Assembly +Inuit Health Branch
Canadian Physicians for the Environment (C.A.P.E.)
Workman's Compensation Board
D.R.D.C. (defence)
David Suzuki Foundation
Municipal community services
Public health departments
Canadian Public Health Association (Kerry Rhoades - Program Coordinator, Health Effects of Climate Change)
Grey Party
School nurses
Farm Network
New Brunswick Partners in Agriculture
Unions

Identify who will take the lead to develop this research, either as individuals or teams.

Not identified by the breakout group

General Discussion and Questions- Both Groups

The 'modeling' and 'synergistic' groups had the opportunity for a general discussion and to raise questions that needed to be addressed by the other group.

Questions asked by the Modelling Group:

Q. What is the most useful scale of modeling for health-based research (ie. degree of resolution on both temporal and spatial scales)?
AND

What is the nature of the need for small scale models, ie. on a project - by - project basis, or is there a need for ongoing model support to answer health questions on a continual basis?

A. There is an ongoing need for small scale for climate-health predictions. Exposure/health is local in spatial range. Also, health researchers require models that predict short-term climatic variability on the scale of 1 to 5 years. This is also the time frame useful to health policy.

Q. How sensitive are the model parameters for the health questions being addressed? Do health people need to know temperatures at year 2050 or another finer scale? (Modelers need a well-defined set of inputs for health models).

A. In addition to the better known parameters, health studies need nighttime temperature changes because they are important values in predicting heat-related mortality in the daytime.

(Editorial note: perhaps implied in this answer is that health studies need finer scales than those suggested in the question - perhaps daily/ nightly averages and ranges as well as yearly scales).

Questions asked by the Synergistic Group:

Q. Where are the uncertainties in climate models and what is the magnitude of these uncertainties?

A1 At present, climate models deal with shorter temporal + larger synoptic scales which are cheaper + easier to produce. The temporal scale for models is accurate on very short scales (3-5 days) and less accurate on the temporal scale of seasons to years. GCMs that predict long term changes (50 -100 years) are more accurate, but health researchers need more regionally-based models and that deal with a temporal scale of 1 to 5 years.

A2 Climate models can provide estimates of exposure in sites that are not covered by monitors. Therefore, there is a need for these models to be more detailed/accurate in their health predictions.

Q. Can health NGOs use climate models for advocacy purposes or to improve public health policies?

Q. The Atlantic area of the country lacks a good climate model, which in turn means that modellers can't provide accurate air quality predictions under climate change scenarios.

The models can identify climate change parameters such as T^{o}, but cannot go the next step and predict with accuracy air quality changes**.**

Additionally, models that link climate change to health are disjunct. There are models that link CC_AP and models that link AP_Health. However, there are none that provide direct linkages between CC_Health unless climate change has a direct measurable impact on health (ie hurricanes on death; heat extremes on death).