

FIXED ON Nitrogen

nitrogen

FIXED ON NITROGEN

CASA Science Symposium on Nitrogen

September 27 – 29, 2006

Fairmont Chateau Lake Louise

Lake Louise, Alberta

program overview

Wednesday, September 27, 2006

OVERVIEW ON NITROGEN

11:00	Registration	
13:00-13:15	Welcome	Peter Watson
13:15-13:30	Overview of CASA	Donna Tingley
	<i>The Clean Air Strategic Alliance (CASA) is a multi-stakeholder partnership, composed of representatives selected by industry, government and non-government organizations. CASA's mission is to recommend strategies to assess and improve air quality in Alberta, using a consensus process. This presentation describes the fundamental elements of the CASA process and highlights some of the successes achieved since CASA was formed in 1994. It will also explain the role of science symposia in the CASA process.</i>	
13:30-14:15	Overview on Nitrogen	Dr. Bridget Emmett
	<i>Through international agreements there has been some success in reducing emissions of nitrogen in Europe and North America. However, within specific regions such as Alberta, and in many other parts of the world, trends are increasing. Sources of this nitrogen are varied and include both dry and wet forms of oxidised and reduced nitrogen. Significant advances have been made in the scientific understanding in many of these areas, which has helped inform policy development, but areas of uncertainty remain. Management approaches in Europe, whilst having some success, have perhaps not been as great as could have been hoped for. Reasons for this are varied but include lack of scientific understanding and the complexity of the nitrogen cycle, lack of technologies to reduce emissions, conflicting policies (e.g. agricultural policy and emissions control), a focus on the wrong industries (industry instead of agriculture and omitting shipping) and cost.</i>	
14:15-15:00	Sources of Nitrogen in Alberta	David Niemi
	<i>Environment Canada in collaboration with Alberta Environment and other provincial / territorial experts prepares comprehensive emissions inventories and projections of Criteria Air Contaminants (CAC) and Greenhouse Gasses for the provinces / territories and Canada. Ammonia (NH₃), Nitrogen Oxides (NO_x: NO & NO₂) and Nitrous Oxide (N₂O) are among the pollutant emissions inventoried. While Alberta NO_x emissions from many sectors are relatively stable or decreasing there has been growth in the Energy sectors. Alberta ammonia emissions have been increasing somewhat mainly due to the agricultural sectors with other sources remaining relatively stable. Work is in progress at Alberta Environment and various CASA teams to reduce the NO_x emissions from many of the leading sectors.</i>	
15:00-15:20	Break	

program overview continued...

15:20-16:05 **Nitrogen Concentrations and Deposition in Alberta** Dr. Karen McDonald

This presentation provides a brief contextual setting for the discussions to follow in the workshop. The state of information on atmospheric concentrations and deposition of nitrogen in the province of Alberta will be presented. Spatial distribution of NO and NO₂ gas concentrations is displayed using monitored results from Alberta's airshed zones across the province. Alberta will be shown in context with other North American cities. Modeled results performed by Alberta Environment demonstrate the changes over time in air concentrations and deposition patterns. Model projections to emissions for the year 2010 will be presented. Hotspots and issues will be identified. The nitrogen changes are demonstrated in contrast to the changes in sulphur over the same time frame to illustrate the relative affect on the overall potential acid input and proportion of critical load affecting the landscape.

16:05-16:50 **Management Approaches for Nitrogen Emissions** Dr. Julian Aherne

17:00-19:00 **Reception**

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Nitrogen Chemistry

7:15-8:15 **Breakfast**

8:15-9:05 **Atmospheric Chemistry of Nitrogen** Dr. Mary Anne Carroll

Photochemical transformation of NO to NO₂, NO₃, and N₂O₅, and further transformation of these compounds to alkyl nitrites and nitrates, peroxyalkyl and peroxyacetyl nitrates, nitrous, nitric and peroxy nitric acids, and ammonium nitrate and the role played by nitrogen oxides in tropospheric oxidant formation (and stratospheric ozone loss) will be reviewed.

9:05-10:00 **Soil, Groundwater and Surface Water Chemistry of Nitrogen** Dr. Shaun Watmough

The behaviour of atmospherically-deposited nitrogen (N) in terrestrial and aquatic ecosystems is complex. A number of processes, internal and external factors ultimately affect the fate of N. Understanding these processes, the factors influencing them, and their response to increased N loadings is of paramount importance for estimating acceptable levels of N deposition that will not adversely impact the environment. The basic processes affecting N transformation in soils and aquatic ecosystems are reviewed, highlighting results from short-term experimental studies and gradient studies that investigate chronic exposure to elevated N. Long-term trends in N export from calibrated catchments in Canada and Europe are described, and the complicating effect of climatic perturbations on chemical patterns is discussed.

10:00-10:30 **Break**

program overview continued...

Thursday, September 28, 2006 Continued

Nitrogen Eutrophication

10:30-11:15 **The General Science of Nitrogen Eutrophication** Dr. Bridget Emmett

Nitrogen eutrophication can be considered as the unintended enrichment of terrestrial and aquatic systems by nitrogen such that changes are observed which are considered harmful or undesirable in the long term. Many factors can influence the impact and fate of nitrogen deposited to an ecosystem and therefore sensitivity can vary between different ecosystem types. Considering depositional factors first, the form of nitrogen deposited is known to affect the responses observed. In general, dry deposition is considered more damaging and some recent evidence from a large scale field experiment will be presented to illustrate this.

11:15-12:00 **Specific Nitrogen Eutrophication Issues** Dr. Per Gundersen

Based on experimental and observational data from boreal forests in Scandinavia, as well as from temperate forests in general, the fate of deposition N in the forest ecosystem will be discussed. Components of the N balance will be examined particularly N accumulation in the plants (trees) and the soil. The development of nitrogen saturation and the controls on N leaching will be considered. Possible indicators of the N status of forest ecosystems (and thereby the susceptibility to N saturation) will be presented. This presentation will be based on the report 'Nitrogen Sinks in Boreal Ecosystems' by Callesen & Gundersen (2004), which is part of the delegate information package.

Direct Nitrogen Health and Environmental Impact

10:30-11:00 **The Direct Health Effects of Various Common Nitrogen Species** Dr. Kathleen Belanger

11:00-11:30 **The Direct Effects of Various Common Nitrogen (N) Species on Vegetation** Dr. Sagar Krupa

There are both direct (atmosphere) and indirect (soil) effects of N deposition on plants and their individual contributions can be apportioned by analytical and computational methods. Excess regional scale N loading can lead to changes in plant growth, reproduction, species fitness, inter-species competition, diversity and ecosystem structure and function.

11:30-12:00 **Odour and Aesthetic Issues associated with Common Nitrogen Species** Dr. Ralf Both

When evaluating odour emissions or odour impacts the measurement of single substances is not useful, as a mixture of a lot of different and often unknown chemical substances causes odour. The presentation summarizes parameters to describe the effects of odours such as odour quality, odour frequency, odour concentration, odour intensity, hedonic tone and odour annoyance including health effects caused by odours. An overview on the different odour measuring (olfactometry, field measurements) and calculation methods (dispersion modelling) with respect to practical experiences will be given. The main focus will be on exposure-response relationships, on results of field investigations in residential areas near industrial installations and livestock operations, and on the evaluation of odour limit values. Finally the well-established odour regulation system of Germany will be presented, where different limit values for residential and industrial areas, based on odour frequencies, have been established to avoid significant nuisances.

12:00- 13:00 **Lunch**

program overview continued...

Thursday, September 28, 2006 Continued

Nitrogen Measurement and Modeling

13:00-13:45 **Atmospheric and Depositional Nitrogen Monitoring** Dr. J. Neil Cape

Measurement of the wet and dry deposition of nitrogen-containing air pollutants is a necessary first step in assessing risks to the environment. Practical guidance is given for the direct and indirect measurement of deposition, and the use of such data to provide valid comparisons with modelled deposition at a regional scale.

13:45-14:30 **Modeling of Nitrogen Dispersion, Ambient Air Concentrations and Deposition** Dr. Paul Makar

This talk describes the processes that must be incorporated into computer models of smog chemistry, focusing on emissions of nitrogen oxides and ammonia, and subsequent reaction chemistry leading to ozone and particle formation. Linkages with scientific advice for government policy makers are discussed, with examples from a recent science assessment.

14:30-15:00 **Break**

Nitrogen Acidification

15:00-15:45 **The General Science of Nitrogen Acidification** Dr. Julian Aherne

15:45-16:30 **Specific Nitrogen Acidification Issues** Dr. Per Gundersen

The proton exchange in the processes of the N cycle will be described and the conclusion that actual acidification only occurs when nitrate is leached from the system will be discussed. However, accumulation of N in the system has the potential to acidify if it eventually leaves the system as nitrate. As N accumulates in the ecosystem other nutrients (or water) may become limiting and nutritional imbalance may develop; this particularly in acidified systems with low nutrient availability. The potential effect of N on the uptake of other elements directly, by changes in growth, or indirectly by ion competition will be discussed.

Nitrogen in Relation to Particulate Matter, Ozone and Climate Change

15:00-15:20 **The Role of Nitrogen in PM and O₃ Formation** Dr. Mary Anne Carroll

Reactions with peroxy radicals transform nitric oxide to nitrogen dioxide (NO₂) without ozone (O₃) loss, and photolysis of NO₂ then leads to O₃ production. Reactions involving ammonia (NH₃), sea salts, and the transformation of NO_x to organic nitrates can lead to the formation of aerosols containing inorganic and organic nitrates.

15:20-15:40 **The Environmental Effects of PM and O₃** Dr. Sagar Krupa

Coarse particles are important close to their sources. Regional scale fine acid particles exacerbate ozone (most important phytotoxic air pollutant world wide) toxicity to plants. Chronic effects of ozone can result in changes in plant: growth, yield, nutrient quality for ruminants, inter-species competition, species fitness, biodiversity and ecosystem structure/ function.

15:40-16:00 **The Health Effects of PM and O₃** Dr. Barry Jessiman

The international perspectives on the health effects of particulate matter and ozone will be presented, as well as the most recent research results, which give insight into the interpretations of the entire body of evidence on this subject, as well as some sense of future directions. The perspectives and evidence on the health effects of NO₂, and the implications of the science for the interpretation of results on different aspects of the air pollution mix will also be presented.

program overview continued...

Thursday, September 28, 2006 Continued

Nitrogen in Relation to Particulate Matter, Ozone and Climate Change continued

16:00-16:30 **Nitrogen and Climate Change** Dr. Chris Evans

This talk will address the range of mechanisms by which man-made nitrogen production can influence climate change. It will consider the negative consequences of nitrogen, such as the production of nitrous oxide, a potent greenhouse gas, but also the potentially beneficial role of nitrogen in enhancing the sequestration of atmospheric CO₂ into terrestrial carbon stores.

18:00 **Gala Dinner** Guest speaker:
Dr. Joe Schwarcz
THE MAGIC OF CHEMISTRY

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Nitrogen Impact Management

7:30-8:30 **Breakfast**

8:30-9:15 **Approaches to the Management of Industrial and Agricultural Nitrogen Emissions and Impacts in Alberta** Ahmed Idriss
Len Kryzanowski

An overview of Alberta Environment's regulatory approach to air quality management will be provided. The approach was initially developed in the late 1960's/early 1970's. Alberta Environment's air quality management system has evolved over time and includes an outcomes focused mix of regulatory approaches and stewardship. Some Alberta air quality issues have been addressed through the Clean Air Strategic Alliance (CASA), which was established in 1994. The re-focused role for Alberta Environment will be one of systems manager, where the role is one of policy development and not necessarily implementation.

9:15-9:45 **Agricultural Nitrogen Control Practices and Options** Dr. Brent Auvermann

Agriculture in developed nations is responsible for a great deal of the accelerating, atmospheric accumulation of reactive nitrogen species produced for intensive crop and livestock production. The limited means by which livestock producers in Alberta can reduce their contributions to the growing atmospheric pool of reactive nitrogen will be explored.

9:45-10:15 **Break**

10:15-10:45 **Industrial and Mobile NO_x Control Practices and Options** Tim Smith

This presentation will discuss industrial and mobile source NO_x control practices in the United States including: (1) utility boiler NO_x and benefits of these reductions (2) industrial NO_x controls for boilers, turbines, and cement kilns and recent permitting experience, and (3) EPA work on mobile and stationary source engine NO_x emissions standards.

10:45-11:15 **Critical Loads for the Management of Nitrogen Acidification and Eutrophication** Dr. Chris Evans

This talk will describe the use of critical loads as a tool for managing the detrimental impacts of nitrogen deposition for terrestrial and freshwater ecosystems. Examples will be given of current approaches, their effectiveness and limitations, and of the potential for developing improved methods in the future.

program overview continued...

Friday, September 29, 2006 Continued

11:15-12:30 **Panel discussion and questions**

12:30-14:00 **Lunch**

Guest speaker:
Dr. Joe Schwarcz
**HEY! THERE ARE
COCKROACHES IN MY
CHOCOLATE ICE CREAM!**

14:00-16:00 **Meetings**

1. Approaches to Odour Measurement and Management
2. Approaches to Ambient Air Quality Objectives for Nitrogen Compounds
3. CEMA/ADAG – Meeting of Group Members

MAIN LOBBY LEVEL

Main Reception
Bell Desk
Concierge Desk
Ski Valet
Fairview Dining Room
Alpine Room
Walliser Stube Wine Bar
Chateau Deli
Lakeview Lounge
Children's Playroom
The Guides Cabin
Shops

UPPER LOBBY LEVEL

Larch Lounge
Pipestone Room

FIRST FLOOR

Victoria Room
Pool and Fitness Centre
Louise Meeting Room
Agnes Meeting Room
Lefroy Meeting Room

LOWER LOBBY LEVEL

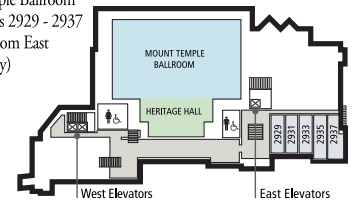
Escape Spa and Salon
Glacier Saloon
Poppy Brasserie
Shops
Access to Lake



MOUNT TEMPLE WING

LEVEL 2

Mount Temple Ballroom
Guest Rooms 2929 - 2937
(Accessible from East Elevators only)



LOWER LOBBY

Business Centre (1)
Conference Services (2)
Beehive Room (3)
Lakeshore Room (4)
Plain of Six Glaciers Room (5)
Saddleback Room (6)

