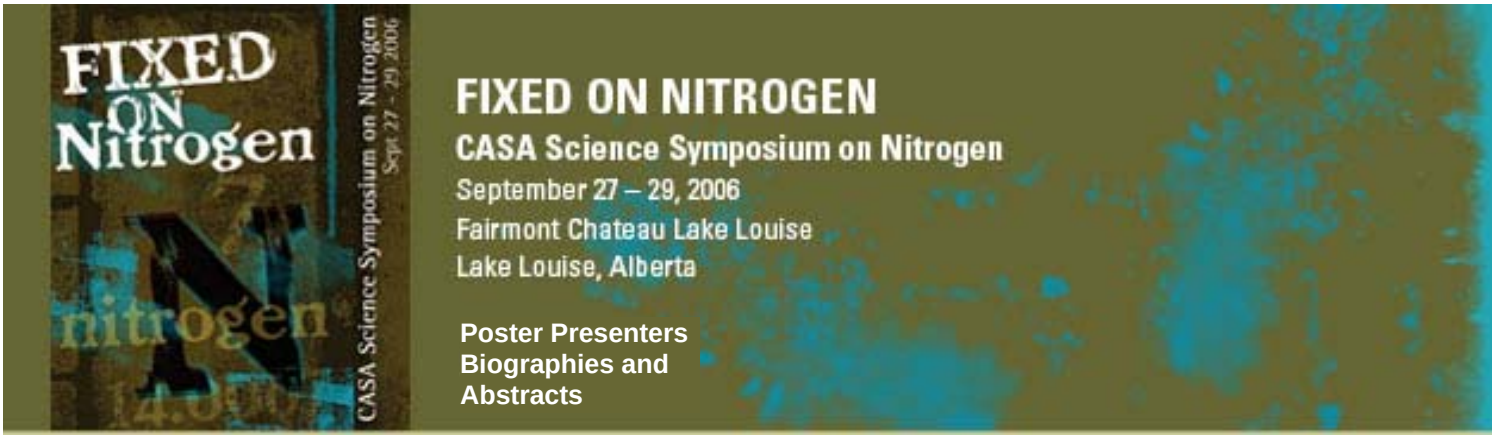

Agricultural Best Management Practices to Reduce Nitrogen Greenhouse Gas Emissions on Surface Applied Nitrogen Fertilizers

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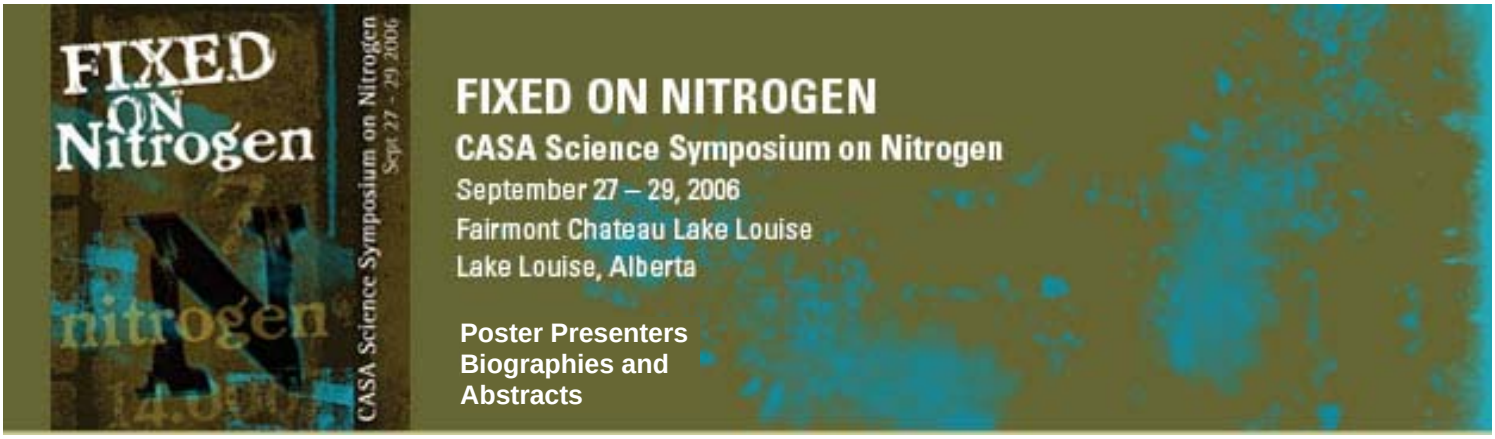
Tom grew up on a mixed irrigated farm in the Coaldale area of Southern Alberta. He studied agriculture at the University of Alberta and received his degrees in BSc Agronomy (79) and MSc Soil Fertility (86) and PhD Agronomy (96). Tom worked in agricultural research and extension for Agriculture Canada, Alberta Agriculture and Agrium before joining Agricore United in April 2003. He works out of the Calgary office and is a technical support to Agricore United staff and customers by advising on soil fertility issues and questions. He manages Agricore United's soil fertility research program.

The use of nitrogen based fertilizers is a common practice in much of agricultural production because nitrogen (N) is usually the most limiting crop nutrient besides water. The increase of energy costs has dramatically increased how much agricultural producers spend on purchasing fertilizers, especially N containing fertilizers, and how much they spend on fuel to power equipment to apply fertilizer. The higher energy costs although initially adverse to farm cash flow has agricultural producers trying new N-fertilizer products and methods to more efficiently apply and use N fertilizer inputs. One area of research is the use of products that will reduce gaseous emissions of ammonia and nitrous oxide from surface-applied fertilizers on forage crops. Lower emissions of the N applied equates to more of the applied N being available for crop use. The results from recent research in Western Canada will be presented.

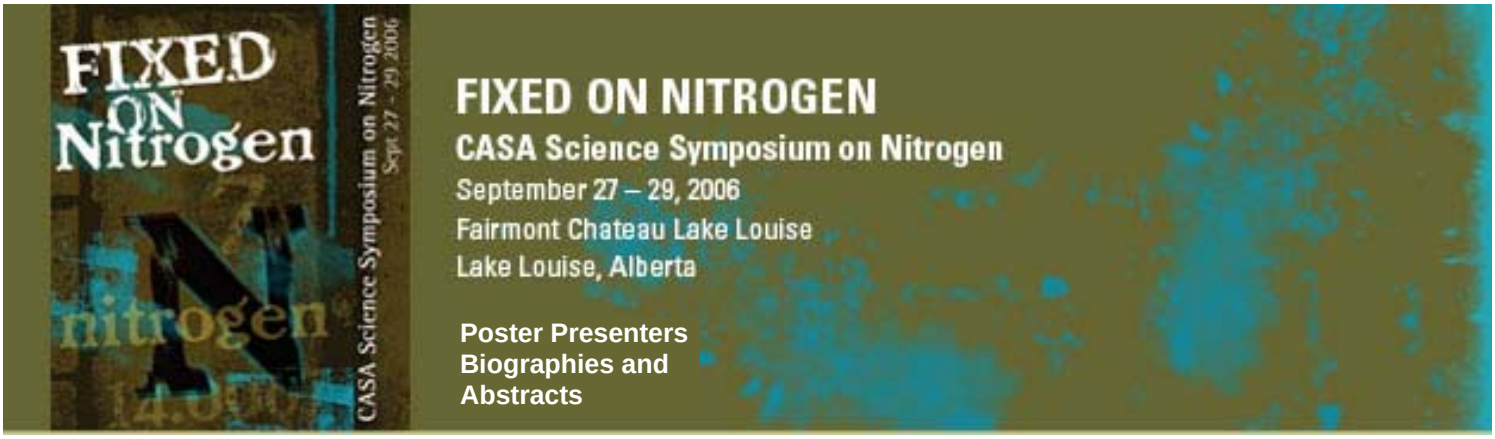


Ammonia impacts from the Poultry industry

Wayne Belzer, Keith Jones
Environment Canada, #201 – 401 Burrard Street, Vancouver, B.C. V6C 3S5, e-mail: wayne.belzer@ec.gc.ca

Wayne Belzer is a Senior Atmospheric Chemist since 1990 at Environment Canada, Environment Conservation Branch, Vancouver, B.C.. To date he has written 7 juried papers, 23 internal reports, 8 conference presentations and 4 posters. He was a Laboratory Analyst from 1972-1990 at the B.C. Ministry of Environment Laboratory and worked as a Chemist from 1968 to 1972 with the International Nickel Company, Process Technology Division, Sudbury, Ontario.

Nitrogen emissions in the form of ammonia have been of interest for air quality because of their ability to react in the atmosphere to form secondary aerosols. Agricultural sources contribute the most to the ammonia loading in the atmosphere. In 2004-2005, we studied the impact of the poultry industry ammonia emissions on air quality before, during and after the poultry cull, resulting from the avian bird flu.



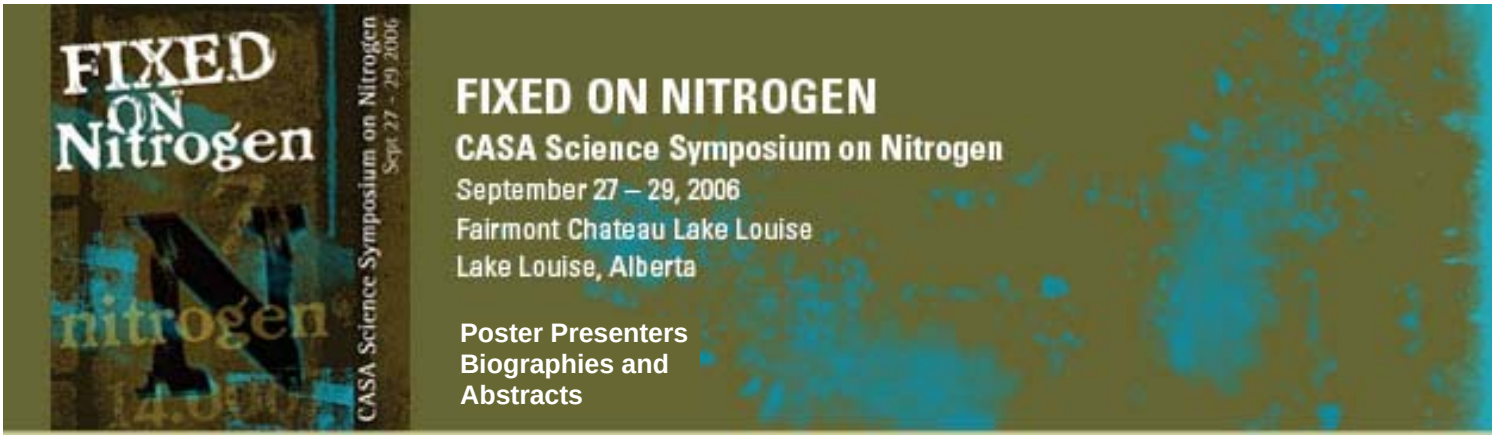
Cumulative Environmental Management Association: The NO_xSO_2 Management Working Group

Nadine Valentijn
NSMWG Program Manager, Alberta Environment, 111, Twin Atria Building, 4999-98 Avenue, Edmonton, AB T6B 2X3, ***Nadine.Valentijn@gov.ab.ca***

Nadine Valentijn is a Regional Sustainable Development Officer with Alberta Environment's Northern Region and is seconded for half of her position to the Cumulative Environmental Management Association (CEMA) as Program Manager for the NOxSO2 Management Working Group (NSMWG). In her role with CEMA, Nadine is responsible for the planning and execution of projects as set out by the NSMWG. This includes managing contracts and grant agreements related to acid deposition, ground-level ozone and eutrophication and working with the group to manage their long-term workplan to develop environmental management frameworks for these three issues.

Through her work with Alberta Environment, Nadine is involved in the development of regional environmental management objectives and environmental management techniques through working with interagency and multi-stakeholder groups. This includes liaising with public groups, government agencies, consultants, industry and regulatory boards to resolve key environmental issues.

The NO_x SO_2 Management Working Group (NSMWG) of the Cumulative Effects Management Association (CEMA) is responsible for developing and recommending management frameworks for oxides of nitrogen and sulphur dioxide emissions as they relate to acid deposition, and subsequently eutrophication and ground level ozone. An Acid Deposition Management Framework and an Ozone Management Framework have been completed and accepted by CEMA by consensus.



Current Scientific Knowledge of Acid Deposition in Canada

Silvina E. Carou
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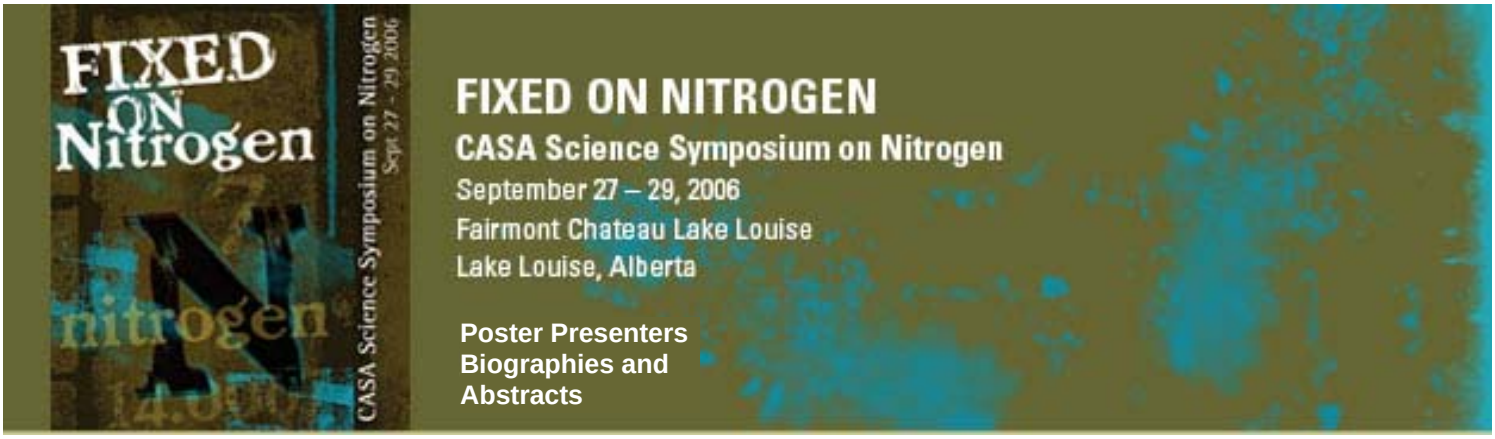
Silvina Carou joined Environment Canada in 2003 to manage the publication of the 2004 Canadian Acid Deposition Science Assessment and to help coordinate the implementation of the department's acid rain science program. In 2005. She was named Air Quality Science Officer and now provides science support on acid rain and smog. She is also a member of the CCME Acid Rain Task Group. Prior to joining Environment Canada, she worked for the Department of Fisheries and Oceans (Burlington, ON) as a Research Technician working on scientific studies on the impact of environmental stressors on freshwater ecosystems. She holds a BSc in Marine Biology from the University of Guelph and is currently completing an MES degree at York University specializing in Science Communication and Environmental Policy.

In 2005, Canada completed a review of the current science and monitoring information on the extent of acid deposition and its effects in Canada, summarized in the *2004 Canadian Acid Deposition Science Assessment.* It is also a comprehensive examination of the atmospheric and ecosystem responses to past sulphur dioxide (SO_2) and nitrogen oxides (NO_x) emissions reductions.

The results of the Assessment confirm that acid deposition is still affecting the environment and health of Canadians, particularly in the eastern region where ecosystems are most sensitive and continue to be subjected to high levels of acid deposition after several decades. Despite significant decreases in sulphate deposition as a result of domestic and international sulphur dioxide emission reductions, many lakes in eastern Canada continue to be acidified and biological communities are being severely impacted. Also, decreases in calcium levels in watershed soils are widespread with consequences on forest health and growth. Although nitrogen acidification is not a problem in most eastern Canadian watersheds, there is already evidence the situation may change once vegetation uptake reaches a saturation point.

At present, there is insufficient information on the capacity of western and northern Canadian ecosystems to assimilate acid deposition without being harmed. The presence of acid-sensitive geology and increasing acidifying emissions suggest that new monitoring efforts should expand into these regions to prevent ecosystem damage from acid deposition. The primary goal of the *Assessment* is to support future decisions by air quality policy-makers on the mitigation of acid rain and restoration of impaired ecosystems. The above and other major findings from the Assessment will be presented.



Exploring the Production of NOx by Lightning and Its Impact on Tropospheric Ozone

Noor Gillani[1], William Koshak[1], Dennis Boccippio[1], Arastoo Biazar[1], Kevin Doty[1], Robert Mahon[1] and Michael Newchurch[1]Daewon Byun[2] and Louisa Emmons[3]
[1]National Space Science and Technology Center (NSSTC), 320 Sparkman Dr., Huntsville AL 35805, USA,

This paper will describe an ongoing research project aimed at improving the poor state-of-the art of our understanding of free tropospheric (FT) chemistry and its simulation. The focus is on improved characterization of the production of NOx by lightning, stratosphere-troposphere exchange, intercontinental transport, and FT-PBL exchange.

Lightning Produced NO_x over the Southeastern United States

Arastoo Biazar[1], Richard T. McNider[1] Muhammad Ghanbari[2]
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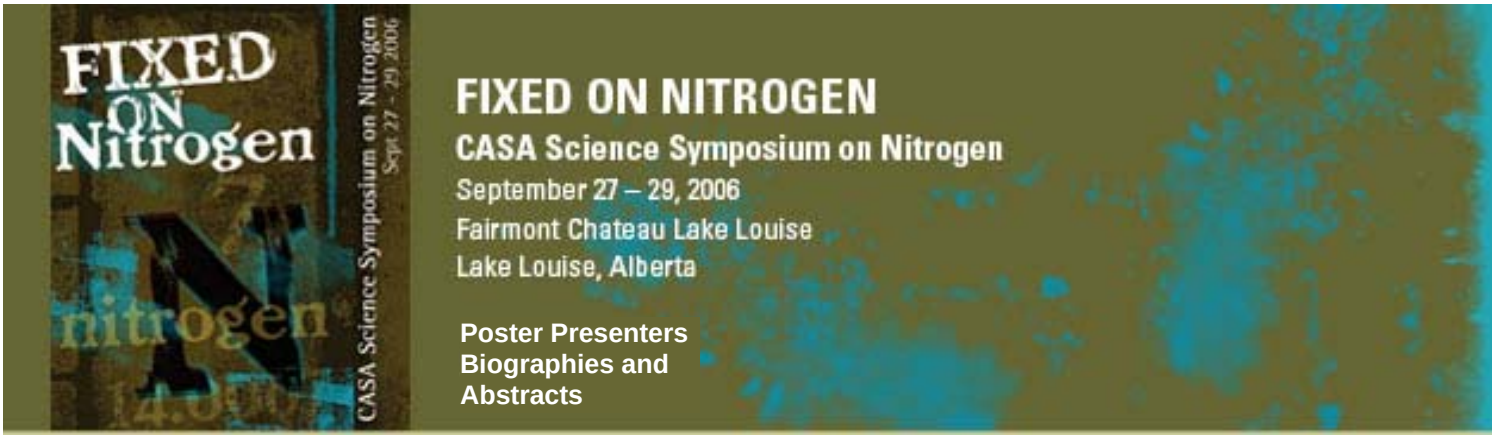
Dr. Pour Biazar has been addressing the issues related to atmospheric modeling and air quality since 1987. He received his PhD in Atmospheric Sciences from the University of Alabama in Huntsville (UAH) in 1995. His dissertation work, being part of the Southern Oxidant Study (SOS), involved an investigation into the role of natural emissions of ozone precursors on ozone production in the southeastern United States. He then joined the Earth System Science Center at UAH and was involved in the development of the EPA's Models-3 Community Multiscale Air Quality (CMAQ) modeling system, developing the Plume-in-Grid module for CMAQ. In 1998 he moved to Australia to participate in global tropospheric chemistry studies at the Cooperative Research Centre for Southern Hemisphere Meteorology at Monash University. During his tenure at CRC, he participated in the construction of a global chemical transport model that was utilized to study the production and the long range transport of the pollutants from the industrial regions. Currently, at the National Space Science and Technology Center, he is developing techniques for assimilating satellite data into the air quality models.

In recent years, Dr. Pour Biazar has been carrying out investigations in air quality with the emphasis on the use of satellite data in this area. He has been working with the State of Texas and participating in Texas air quality studies. Currently, under a NSF funded project, he is investigating the role of LNOx in the chemical composition of free troposphere over United States.

Summertime distribution of lightning and the potential importance of lightning-generated NOx (LNOx) over the United States were investigated. Data from NLDN for summer of 1989 through 1992 were utilized. The results from this study suggest that estimates of LNOx in the southeastern United States could be comparable to the anthropogenic sources.



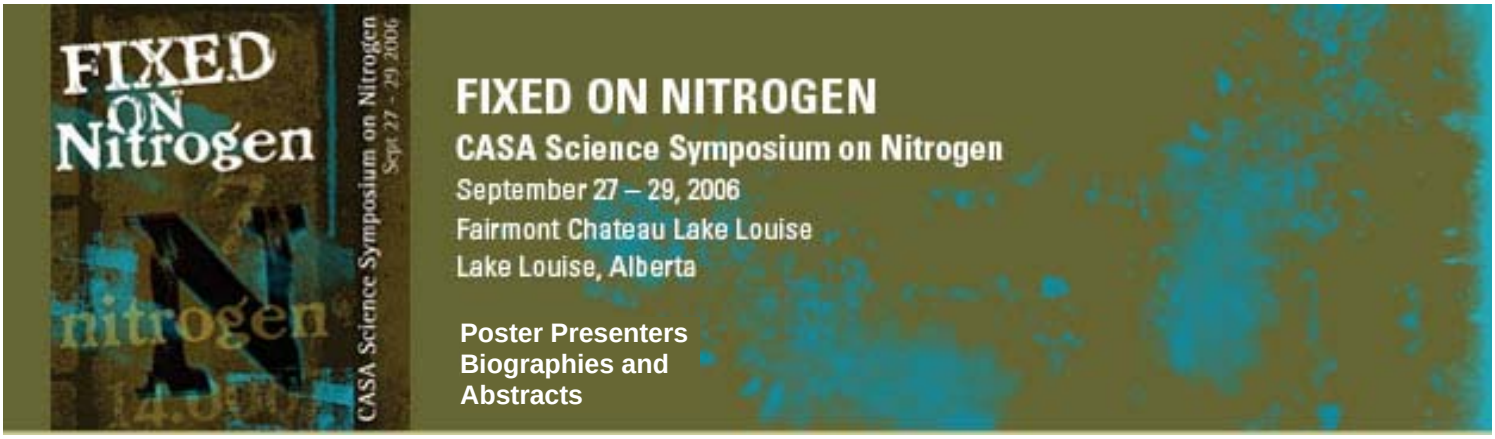
Measurement of Ambient Gaseous Ammonia in Agricultural Areas of the Canadian Prairies

Wally Qiu, Kristina Friesen, Monique Lapalme
Meteorological Service of Canada , Environment Canada: Prairie and Northern Region, #200, 4999-98 Avenue, Edmonton, AB, T6B 2X3, Wally.Qiu@EC.gc.ca, Kristina.Friesen@EC.gc.ca, Monique.Lapalme@EC.gc.ca

Kristina received her Bachelor's Degree (specialization) in Chemistry at the University of Alberta (Edmonton, Canada) in 2003. During her undergraduate studies, Kristina worked with the Environment Canada Air Quality group in Edmonton as an intern studying and applying source apportionment methods to ambient particulate matter measured at Elk Island National Park. After completing her undergraduate degree Kristina worked in the research and development department of Raylo Chemicals before returning to work with the Environment Canada air quality sciences group in January 2004. Kristina's primary project is the investigation of ambient ammonia in agricultural areas of the prairies; she also supports other research activities and maintains a strong interest in source apportionment techniques and the application statistical techniques to environmental data in general.

Wally is currently completing his Bachelor's Degree in Chemistry (Specialization) at the University of Alberta and is participating in the Industrial Internship Program in a placement with the Environment Canada Air Quality group. Driven by an interest in environmental conservation; Wally's primary project is the investigation of ambient ammonia in agricultural areas in the Canadian Prairies and he is responsible for the field program, laboratory analysis and data interpretation. Wally has previously been involved in research into application of surface analytical chemistry towards the development of atomic force analysis techniques utilizing nanoparticles (Department of Chemistry, UofA) and modification of developmental materials used towards nanoscale bio-resonator sensors (National Institute of Nanotechnology, UofA).

In spring of 2006 Environment Canada's Prairie and Northern Region established a small scale monitoring network designed to measure the concentration of gaseous ammonia in agricultural areas of Southern Alberta and Southern Manitoba. This monitoring will contribute to a nation-wide passive ammonia sampling network investigating ambient ammonia levels related to agriculture. The primary ammonia emissions in the two study areas are expected to be related to livestock and crop farming. Sampling of gaseous ammonia is done by the use of Ogawa passive samplers. Samplers are placed in the field at varying distances from expected sources. Ogawa samplers consist of a simple Teflon cylinder, which houses a small citric acid impregnated glass filter. The filters are exchanged at regular, timed intervals and then analyzed for ammonium concentration via colorimetric analysis. This network will provide temporal and spatial data to assess ambient ammonia levels in two areas of the prairies. This poster will introduce the ammonia network in Southern Alberta and Southern Manitoba and provide some preliminary data.



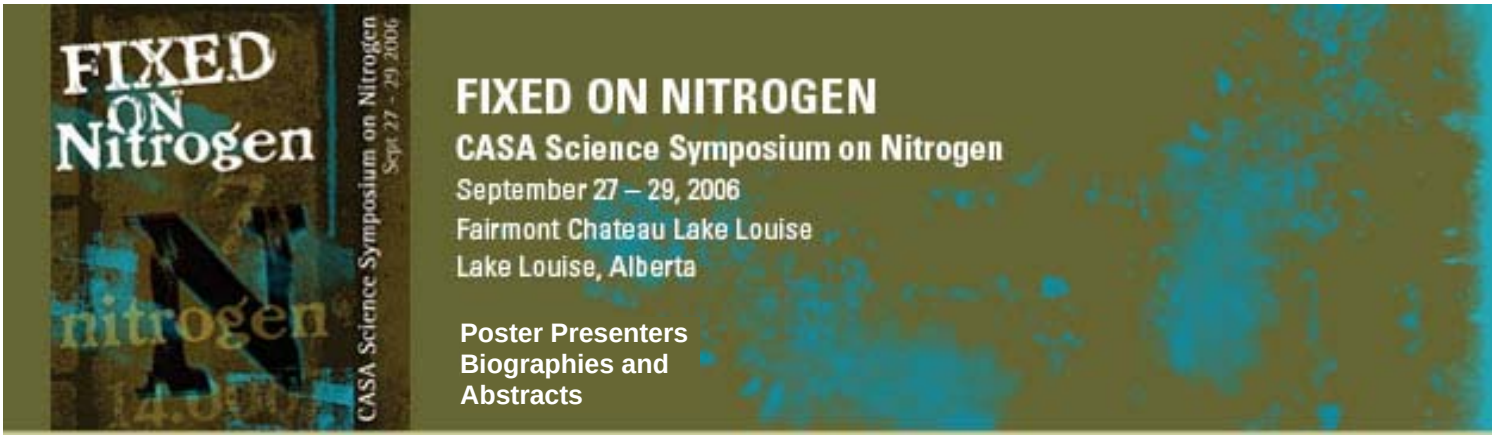
Measurements and Modeling of Atmospheric Ammonia Emissions from a Dairy

Brian Rumburg, Jack Chen, George H. Mount, Jenny Filipy, Brian Lamb, Hal Westberg, David Yonge, Ron Kincaid, Kristen Johnson
Department of Civil & Environmental Engineering, Washington State University, Pullman, WA USA 99164-2910, brumburg@wsunix.wsu.edu

Dr. Rumburg earned a bachelor's degree in Civil Engineering, a master's degree in Environmental Engineering and a doctorate in Civil Engineering from Washington State University. His dissertation was on measuring and modeling ammonia emissions from dairies. He is currently a postdoctoral researcher at Washington State University, studying gaseous nitrogen emissions from feedlots and from potato and cornfields. He is interested in studying anthropogenic changes to the global nitrogen cycle.

Atmospheric ammonia (NH3) effects on the atmosphere, environment, and human health is not well understood due to a lack of information about ammonia's emissions, transport, and fate. The largest anthropogenic source of atmospheric NH3 is animal excreta, and dairy cows are the largest per animal emission source.

The objectives of this work were to measure NH3 emissions from the Washington State University (WSU) dairy and develop an emissions model for use in the Community Multiscale Air Quality (CMAQ) Model. The total annual emissions are estimated to be 130 kg NH3 cow-1 yr-1, with 40 kg from housing, 55 kg from waste lagoons, and 34 kg from waste application. Annual emissions are in excellent agreement with annual N mass balance of the dairy. This is significantly larger than the EPA estimates, which are based upon European data. Measurements, model development, and air quality modeling results will be shown.

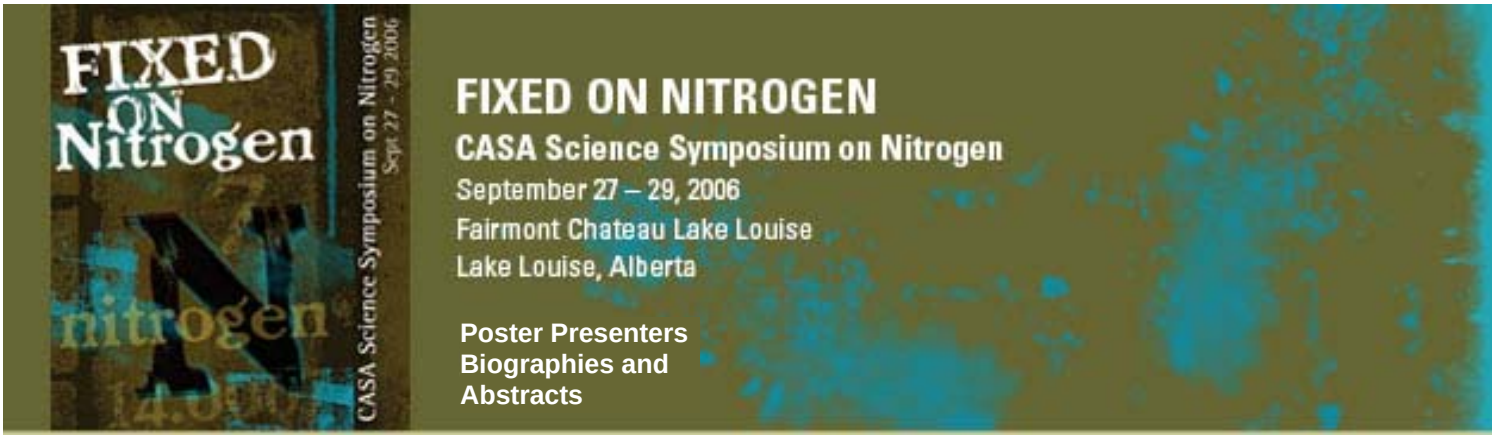


N_2O emissions from geologic nitrate in groundwater in southern Alberta?

Ryan, M.C.[1], K.N. Lorenz[2], X. Hao[3], C. Chang[3]
[1] Department of Geology and Geophysics, University of Calgary, 2500 University Dr. N.W., Calgary AB T2N 1N4. cryan@ucalgary.ca [2] Department of Chemistry, University of Calgary, 2500 University Dr. N.W., Calgary AB T2N 1N4. (Currently at the Natural Resources Conservation Board, Lethbridge Research Centre, 5403 1st Ave, P.O. Box 3000, Lethbridge, AB. T1J 4B1.) [3] Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403 1st Ave, P.O. Box 3000, Lethbridge, AB. T1J 4B1.

Dr. Cathy Ryan is an Associate Professor cross appointed to the Department of Geology and Geophysics. Her research program includes work on the fate of nitrogen in groundwater and rivers, and the sampling and analysis of dissolved gases in groundwater.

A monitoring study conducted to evaluate agricultural sources and sinks of N_2O suggests that N_2O degassing from deep groundwater can be significant. The N_2O source could be denitrification of geologic nitrate at the 'redoxcline' (the boundary between the oxidized and reduced zones about 16m below ground surface).

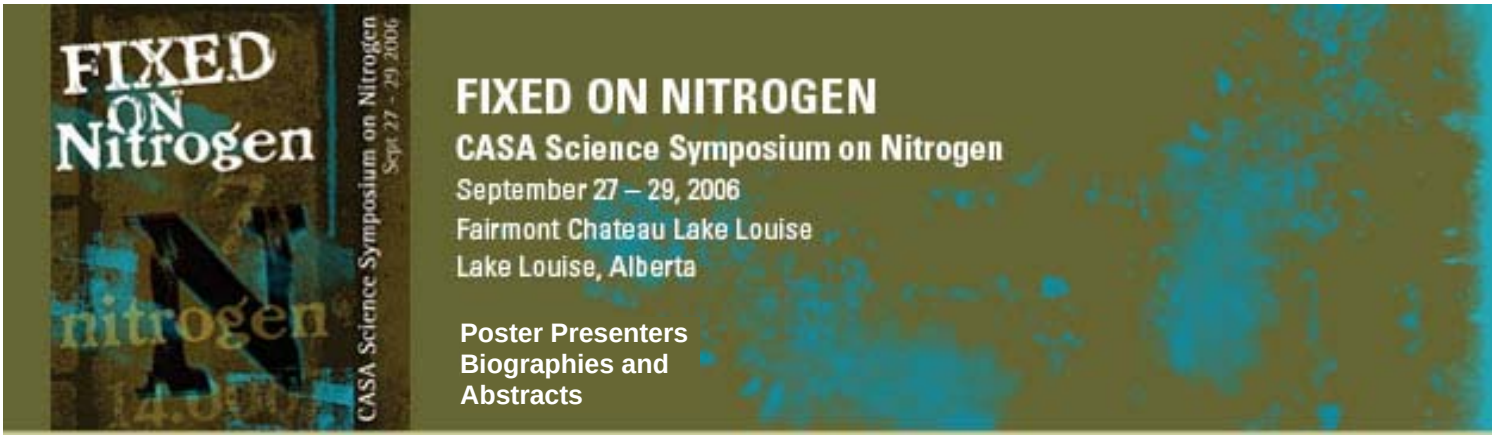


Nitrogen Dry Deposition in Alberta

Warren Kindzierski[1,2] Mohamad Gamal El-Din[2] Lawrence Cheng[3]
[1] Seacor Environmental Inc., Edmonton, AB, [2] Dept. of Civil & Environmental Engineering, University of Alberta, Edmonton, AB, [3] Environmental Policy Branch, Alberta Environment, Edmonton, AB
Warren B. Kindzierski, Ph.D., P.Eng., Technical Director, Air Quality, SEACOR Environmental Inc., Edmonton, Alberta, wkindzierski@seacorcanada.com

Dr. Kindzierski is a Professional Engineer with 25 years engineering, academic, and consulting experience. He has 16 years experience in dealing with air quality issues and human exposure/health risk assessment of environmental pollution. He was an Associate Professor of Environmental Engineering at the University of Alberta for nine years and continues to pursue research at the University. During the past ten years he has trained 30 graduate students in projects related to behaviour of chemicals in the environment. He also held a past appointment as Adjunct Professor in the Department of Public Health Sciences at University of Alberta (1992 to 1996).

A study was conducted in Alberta to examine approaches used for measuring dry deposition and to identify whether a relatively economical technical approach can be put into practice for estimating dry deposition of acidic substances. Three different inference models (developed by Environment Canada, Alberta Environment, and the Wood Buffalo Environmental Association) used in Canada for estimating sulphur and nitrogen species dry deposition were evaluated. Contributions of sulphur and nitrogen compounds to total sulphur and nitrogen dry deposition were determined. Although this paper focuses on nitrogen species, a summary of sulphur species will also be presented. Estimates of nitrogen species deposition at Fort McKay, Alberta indicated that about 51% was from NO_2 with the reminder as HNO_3 and HNO_2 (35%) and particulate NH_4^+ and NO_3^- (14%), while at Beaverlodge, Alberta about 35 to 50% was from NO_2 with (40 to 60%) from HNO_3 and HNO_2, and less than 10% from NH_4^+ and NO_3^-.

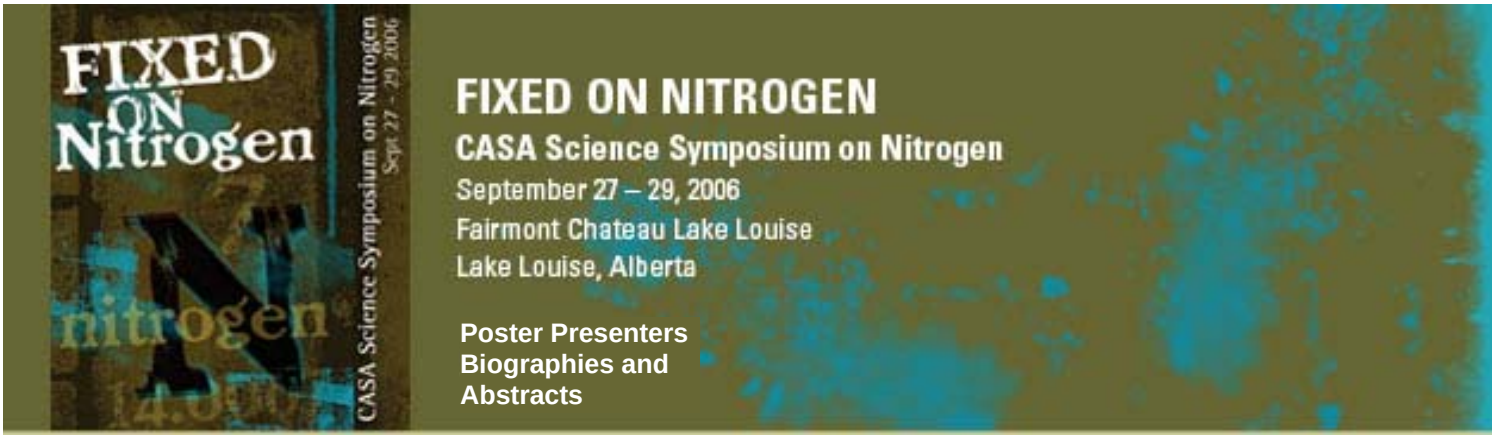


Nitrous oxide emissions from a hummocky landscape in central Alberta with annual cropped uplands

Tom Goddard[1], Len Kryzanowski[1], Tony Brierley[2]
[1] Alberta Agriculture, Food and Rural Development, #206, 7000 – 113 St. Edmonton, Canada T6H 5T6, tom.Goddard@gov.ab.ca, [1] (same mailing address), len.kryzanowski@gov.ab.ca , [2] Agriculture and Agri-Food Canada, (same mailing address) tony.brierley@gov.ab.ca

Len Kryzanowski, P.Ag., is a Provincial Nutrient Management Specialist with Alberta Agriculture, Food and Rural Development. He completed his B.Sc. Agriculture, Agronomy (1977), and M.Sc. Soil Science, Soil Fertility (1982) at the University of Alberta. He is currently working on his Ph.D. on modeling landscape dynamics for precision agriculture. His 26 years of research and extension work with the department has focused on various aspects of nutrient management, including soil testing, nutrient calibrations, fertilizer recommendations, soil and crop diagnostics for agricultural crops, and development of Decision Support Systems for nutrient management and crop adaptation. Other areas of research include nutrient management for precision agriculture, the use of agronomic simulation models, manure management, and greenhouse gas emissions from agricultural soils.
Other interests include gardening, photography and volunteering for the Edmonton Folk Music Festival.

Nitrous oxide emissions from a hummocky landscape in central Alberta with annual cropped uplands
Nitrous oxide emissions were measured along toposequences within an agricultural hummocky landscape in central Alberta. Ephemeral wetlands associated with the depressional areas have undisturbed grassed and willow-ring riparian zones. . Emission events in the upland were related to spring thaw and fertilization, in the wetlands they were related to recession of the water. Emissions are different between wet versus dry years.



Personal Exposure Assessment of Nitrogen Dioxide in Air

Jonathan Robb, Alex MacKenzie, Donald Schopflocher, and Susan Shaw
Health Surveillance, Alberta Health and Wellness, Edmonton, Alberta, Canada

Jonathan Robb is currently Acting Manager at the Public Health Surveillance and Environmental Health Branch of Alberta Health & Wellness in Edmonton. Since 1996, Jonathan has been integral in the development and management of many large environmental health related initiatives known as the Community Exposure and Health Effects Assessment Program. Highlighting the importance of accurately assessing personal exposure, these province-wide initiatives focus on enhancing our understanding of the associations between air quality, human exposure, and human health.
Jonathan is also an active member of the Clean Air Strategic Alliance, Wood Buffalo Environmental Association, and Parkland Air Management Zone. He provides support and collaborates with various multi-stakeholder committees focused on environmental health issues.

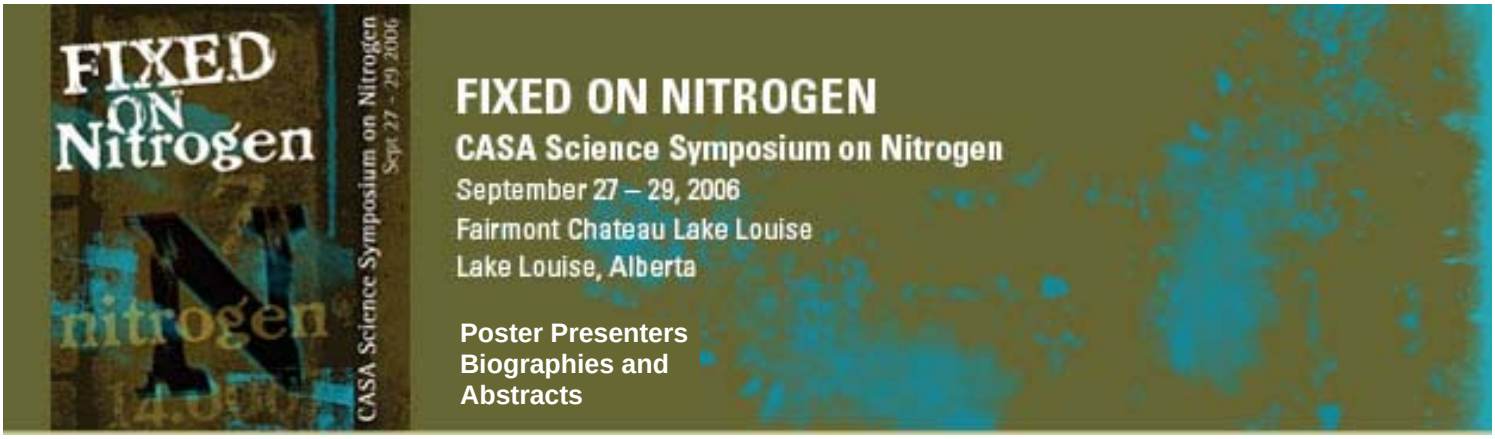
The poster will provide an overview of the Community Exposure and Health Effects Assessment Program and how its innovative personal exposure assessment methodology has accurately measured the level of nitrogen dioxide that approximately 800 individuals from five communities across Alberta have been exposed to in their everyday microenvironments.

Sensitivity Indices of Acidification of Some Forest Soils in the Oil Sands Region in Alberta

Yong Sik OK, Scott X. Chang, Yongsheng Feng
Department of Renewable Resources, University of Alberta, 4-42 Earth Sciences Building, Edmonton, Alberta, Canada T6G 2E3, yongsikok@ualberta.ca

Dr. Yong-Sik Ok joined the Department of Renewable Resources as a Postdoctoral Fellow working with Dr. Scott Chang and Dr. Yongsheng Feng. The main research responsibility of Dr. Ok is to evaluate the role of N and S cycling in soil acidification in forest ecosystems in the oil sands region of Alberta. He will also participate in other projects related to his research interest in soil chemistry. Dr. Ok completed his PhD degree at Korea University and was a Postdoctoral Fellow at Korea University and Kangwon National University in Korea.

Simple chemical indices such as δpH, pH_{NaF} and soil acid-buffering capacity can be used to evaluate the impact of accelerated acid deposition (as NO_x and SO_2) on soil acidification in forest ecosystems in the oil sands region of Alberta.



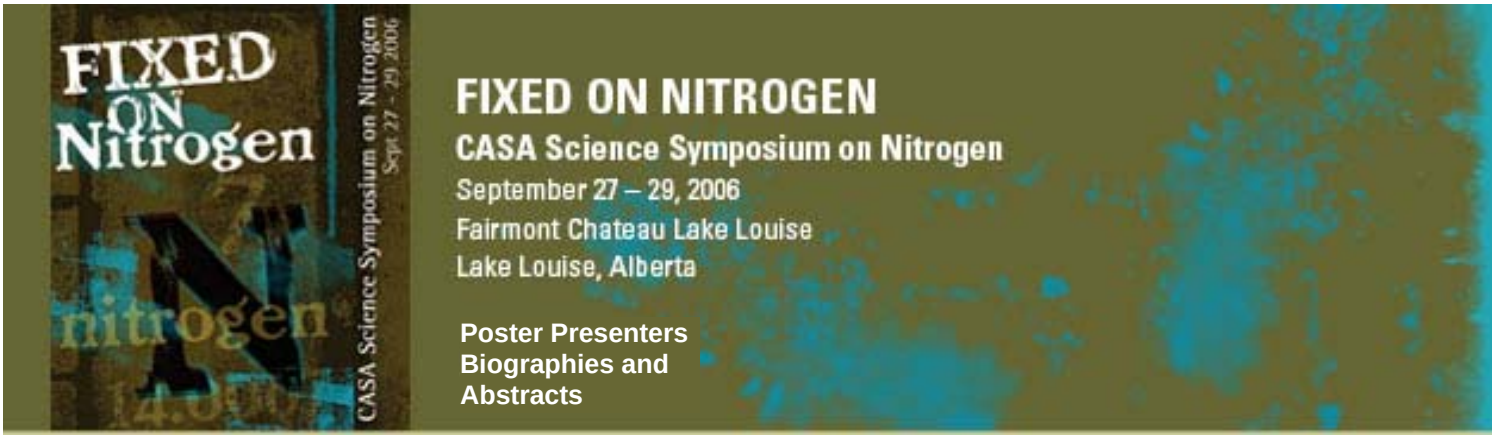
The Effect of NO_X Emissions Standards on Future Industrial Developments: An Oil Sands Case Study

T. Comis, G. Unrau, K. Onder, F. Onder
tracy_comis@golder.com, greg_unrau@golder.com

Tracy Comis is an Air Quality Scientist with Golder Associates Ltd. Tracy received a B.Sc. in Environmental Science in 2001 and a M.Sc. in Environmental Chemistry in 2003, both from the University of Calgary. Her Masters thesis involved characterization and quantification of organic compounds in ambient air in central Alberta.
Tracy has worked with Golder since 2004. She has been involved in a wide range of projects throughout Canada. She has been extensively involved in oil sands air quality assessments for environmental impact assessments (EIAs), including the Suncor Voyageur, Albian Sands Muskeg River Mine, Imperial Oil Kearl and Canadian Natural Primrose East projects. Her primary areas of expertise include air emission inventories, air quality dispersion modelling and ambient air quality data analysis. Tracy also has experience in the development and implementation of ambient air quality monitoring programs.

Greg Unrau is an Air Quality Meteorologist with Golder Associates Ltd. Greg received a B.Sc. in Atmospheric Sciences in 1992 and a M.Sc. in Atmospheric Sciences in 1996 from the University of British Columbia. Greg is an Associate and has worked as an air quality meteorologist in Canada for the last ten years. He has been involved in the modelling and assessment of atmospheric emissions from a variety of resource clients including Oil and Gas, Oil Sands, Forestry, Chemical Processing and others. He has experience providing both management and technical support on several large air quality impact assessments including the Mackenzie Gas Project, the Shell Jackpine Mine – Phase 1 EIA and hearings, and the CNRL Horizon Project EIA and hearings. His skills include dispersion modelling, preparing 3-dimensional meteorological data sets (e.g. CALMET), meteorological evaluations, ambient monitoring and project management.

The effects of different standards on NOX emissions from cogeneration units and off-road diesel vehicles are investigated, as well as the cost implications of NOX emissions controls. A case study is presented which determines whether differences in NOX emissions standards have an effect on predictions of potential acid input (PAI). Calculations show that the size of a cogeneration unit determines whether the CCME or Alberta Environment standard is most stringent for a given piece of equipment, and one standard is not consistently more or less stringent than the other. Therefore, developers must consider both standards when determining NOX emission limits to ensure that the most stringent standard is met. A case study of an oil sands mine demonstrates that the reduction in NOX emissions associated with newer mining equipment has a large effect on potential acid input (PAI) predictions in the region. Newer off-road diesel vehicles have lower NOX emissions limits because of improved emissions control technologies. As older vehicles are replaced with updated equipment, this will result in large decreases in NOX emissions from oil sands mines.



The fate of Nitrogen Oxides emitted from Oil Sands Processing Facilities

Martin Buhr[1], Randy Rudolph[2], Jan Shi[2], Maxwell Shauck[3]
[1]Air Quality Design, Inc., Golden, Colorado, [2]AMEC Earth and Environmental, Calgary, Alberta, [3]Baylor University, Waco, Texas
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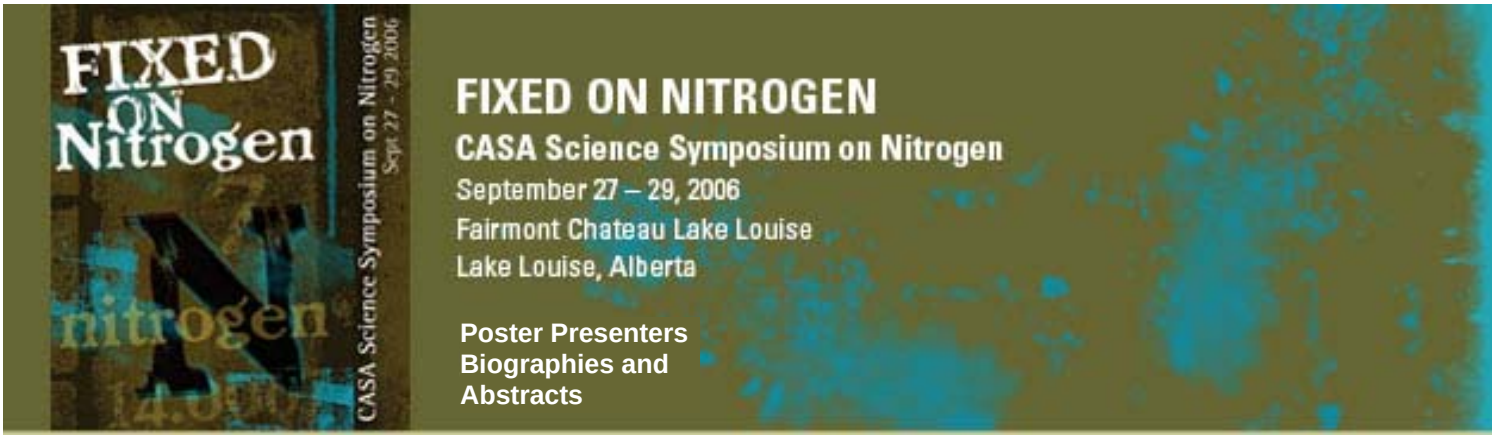
marty@airqualitydesign.com

Dr. Martin Buhr is the principal scientist with Air Quality Design, Inc located in Golden, Colorado USA. He has 20 years of experience in trace gas measurements and sensor development. Air Quality Design, Inc. specializes in production of high sensitivity, rugged, and miniaturized instruments for measurement of NO, NO_2, NO_y and other trace species.

Air chemistry measurements were collected from an airborne platform during the summers of 2001 and 2002 in the oil sands region near Ft. McMurray, AB. Measurements included ozone, nitrogen oxides (NO, NO_2, NO_y, HNO_3), SO_2, VOC's (canister analyses), light scattering and meteorological parameters to gain a better understanding of the potential impact of increasing NO_x emissions from oil sands processing facilities in the region. While moderate ozone formation was observed in dilute plumes, the physical characteristics of the atmosphere typically favored formation of HNO_3 without commensurate ozone formation. Analysis of the data demonstrated strong nitrogen deposition from compact plumes.



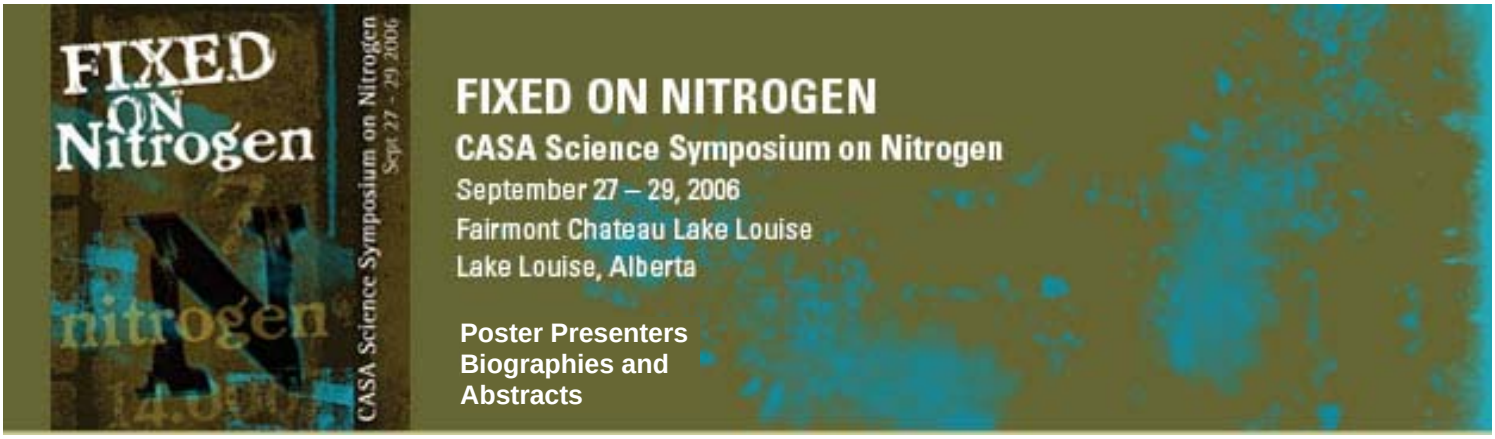
Terrestrial Environmental Effects Monitoring (TEEM): Nitrogen Monitoring in the Oil Sands Region, Alberta

Ted Sutton, TEEM Program Manage, Wood Buffalo Environmental Association

E:mail: cornerposts@gmail.com

Ted is the newly appointed Terrestrial Environmental Effects Monitoring (TEEM) Program Manager as part of the Wood Buffalo Environmental Association (WBEA) organization. He comes to WBEA following a career as an educator concluded as Dean of the current School of Agriculture and Environmental Sciences at Lakeland College in Vermilion, Alberta. He has taught a wide range of related courses and looks forward to working with the WBEA and TEEM Committees as they pursue environmental developments and issues in the Athabasca Oil Sands region. The Oil Sands Region of northeastern Alberta is the location of one of largest oil industrial developments in the world. Two major mining operations have been operating since the 1970's, a third facility commenced operation in 2002 and a number of new insitu and mining facilities have subsequently been approved or are in the approval or planning phase. Present indications are that development in the form of new or expansions to existing projects will continue over the coming decades. One of the environmental issues identified by stakeholders in the oil sands region are the effects of air emissions, particularly nitrogen, on natural forest ecosystems.

The Terrestrial Environmental Effects Monitoring (TEEM) Program, within the Wood Buffalo Environmental Association, is currently undertaking monitoring of ammonia (NH_3) and nitric acid (HNO_3) in the Oil Sands Area as part of the forest passive monitoring program. These passive monitors were developed by the United States Forest Service (USFS) -Riverside, California and their use on a trial basis has been in collaboration with the USFS. Preliminary data from the passive monitoring program are presented.



Development of the Agricultural Ammonia Science Assessment

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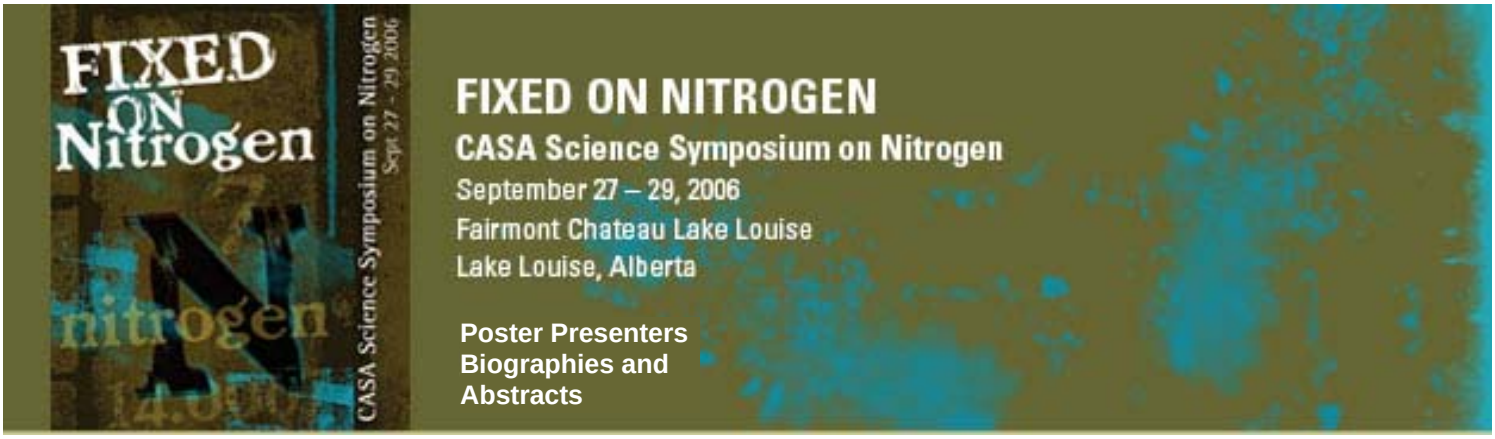
Under the National Agri-Environmental Standards Initiative (NAESI), the Air Theme is undertaking the Agricultural Ammonia Science Assessment. The objective of the Science Assessment is to provide a comprehensive and credible synthesis of the scientific information available on ambient ammonia and its effect on particulate matter concentrations in Canada. Within the NAESI Air Theme, considerable scientific research is underway that will feed into the Agricultural Ammonia Science Assessment, including: improvements to the national ammonia emissions inventory using updated, Canadian specific, agricultural activity data and emissions factors; quantitative descriptions of ambient ammonia concentrations and their relationship to agricultural activities across Canada; development of different ammonia deposition velocities for various land use categories; quantitative indications of the sensitivity of ambient particulate matter concentrations to changes in ammonia emissions across the country; and regional air quality modelling analyses of the sensitivity of particulate matter concentrations to changes in ammonia emissions. NAESI is a multi-year project and the delivery in 2008 of the Agricultural Ammonia Science Assessment will provide the scientific basis for recommending a suite of non-regulatory performance standards. These standards will likely take the form of a range of recommended regionally-specific reductions in agricultural ammonia emissions and the Science Assessment will describe the potential impacts of such reductions on local and regional air quality.



Review of NO_x Dispersion, Deposition and Chemistry Assumptions in the CALPUFF Model Applied to the Athabasca Oil Sands Region

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Over the last decade, there has been a significant increase in the number of operating and proposed bitumen recovery and upgrading activities in the Athabasca Oil Sands region. These activities release nitrogen oxides (NO_x) to the atmosphere. Future NO_x emissions are expected to increase by a factor of 7 to 10. Given the potential effects of these emissions on the ecosystem, the NO_xSO_x Management Working Group (NSMWG) commissioned a study to assess the performance and suitability of the CALMET-CALPUFF modelling system for estimating nitrogen (N) deposition in the region.
The evaluation approach consists of four steps:

- review of the regional setting including emission sources, ambient concentration measurements, regional deposition calculations and regional meteorology
- critical review of the CALPUFF model assumptions and the chemistry mechanisms to determine the "best practical science" application of the model to the oil sands region
- comparison of measured and predicted N species concentration and deposition
- application of the CALPUFF model to provide a regional baseline indication of the magnitude and spatial variation of N species concentration and deposition patterns.

Sensitivity analysis applied to the two major source types (area source and point source) and model comparison to the ambient air quality data in the oil sands region suggest that RIVAD/ARM3 chemical mechanism performs better among three available chemical mechanisms in the CALPUFF modelling system. The use of measured hourly ozone concentrations with the Ozone Limiting Method (OLM) for NO to NO_2 conversion appears to show the best agreement for the higher NO_x concentration regime. There is a consistent underprediction at lower NO_x concentration range, no matter which chemistry mechanism was applied. Local emission sources in remote areas, the simplified NO_x-O_3-VOC mechanism and bias of meteorological predictions may contribute to the uncertainties of the modelling results. The model evaluations indicate the overall model performance is reasonably good.
To improve the reliability of predicting N deposition to the regional ecosystem, an accurate emission database and a better understanding of the background concentrations (including ozone levels) are required. Extending ambient monitoring program to include other N species and N wet and dry deposition at representative background and mine-pit locations will help to adjust critical chemical parameters in the model (such as ambient ammonia levels, hourly ozone levels at different areas, deposition velocities, etc.). Overall, the CALMET-CALPUFF modelling system appears to be suitable for the region and the resulting reliability and confidence in the model predictions will be increased through the suggested improvements.