



Sources of Nitrogen in Alberta

CASA Science Symposium on Nitrogen

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Environment Canada

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Presentation Outline

- **Emissions Inventory and Projections, Background and Requirements**
- **Emissions Inventory analyses**
 - National & Provincial Trends, Maps
 - Nitrogen Oxides,
 - Ammonia,
 - Nitrous Oxide.
- **Emissions Reduction Programs**
- **Inventory improvement**
- **Conclusions**

Focus of presentation on Nitrogen Oxides and Ammonia with Nitrous Oxide emissions information





Pollution Data Division

Centre within Environment Canada and the federal government responsible for identifying, analyzing, and quantifying sources of pollutants affecting human health, the environment, and the economy.

Responsibility to:

- Collect information/statistics on the emission sources
- Collect annual emissions information through NPRI
- Develop emission estimation methodologies
- Compile the emission inventories, trends, and projections
 - Summary of the various emission sources
- Analyze the emission trends and projections
- Disseminate the information (reports, web, AQ Modelling)





Requirements For Emission Inventories and Projections

Required to:

- Track progress of current emission reduction programs and initiatives, and evaluate the needs for adjustments
- Scientific assessment and understanding of the air pollution problems
- Inform the public about the releases in their communities, and enable them to take action to protect the environment
- Fulfill the reporting requirements of domestic and international protocols and agreements





Comprehensive Emissions Inventories

Compiled for various air pollutants that contribute to environmental effects such as smog, acid rain, and visibility

Criteria Air Contaminants

- Nitrogen Oxides (NO_x), Sulfur Dioxide (SO₂),
- Volatile Organic Compounds (VOC), Particulate Matter (TPM, PM₁₀ , PM_{2.5})
- Carbon Monoxide (CO), Ammonia (NH₃)

Heavy Metals

- Mercury (Hg), Lead (Pb), Cadmium (Cd)

Persistent Organic Pollutants

- PAH, Dioxins & Furans, HCB

Green House Gases

- Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O)

Compiled in collaboration with the provincial, territorial, and regional environmental agencies



Emissions Inventory Improvements

- **Continuous improvements to the emission inventories are required to reflect the latest:**
 - data available (obtained through technical studies, surveys, etc.)
 - knowledge on the emission sources
 - new estimation methodologies
 - new measurement techniques
 - More measurements are required to validate the emissions reported to the NPRI by industries and for the development of Canada specific emission rates
- **Improvements are required to provide a more accurate accounting of the emissions**
 - Track the progress of current emission reduction strategies and evaluate the need for future adjustments
 - Air quality modelling in Canada and in the U.S.
 - Development of daily air quality predictions
- **EPWG technical sub-groups with the industry are still in place for further improvements to the emission estimates (transportation emissions, Upstream oil & gas)**



Emissions Inventory Improvements

Current Emissions Inventory Improvements

- On-road transportation reflecting the data compiled through the inspection and maintenance programs, analysis of the effect of new fuel blends
- Fugitive emissions from petroleum refineries through measurement using a new laser based technology
- Measurement of condensable PM and VOC emissions from the Pulp and Paper industry
- Detailed surveys to refine the emission estimates from the use of solvents
- Estimation of the NH₃ emissions from poultry operations
- Improvement of the emission estimates for the Upstream Oil and Gas industry and the Oil (Tar) Sands

- Annual inventories beginning with the 2002 data year (previously 5 year cycle).
 - NPRI reporting of CAC emissions began in 2002
- 2003 – 2005 Emissions inventories available in Spring 2007



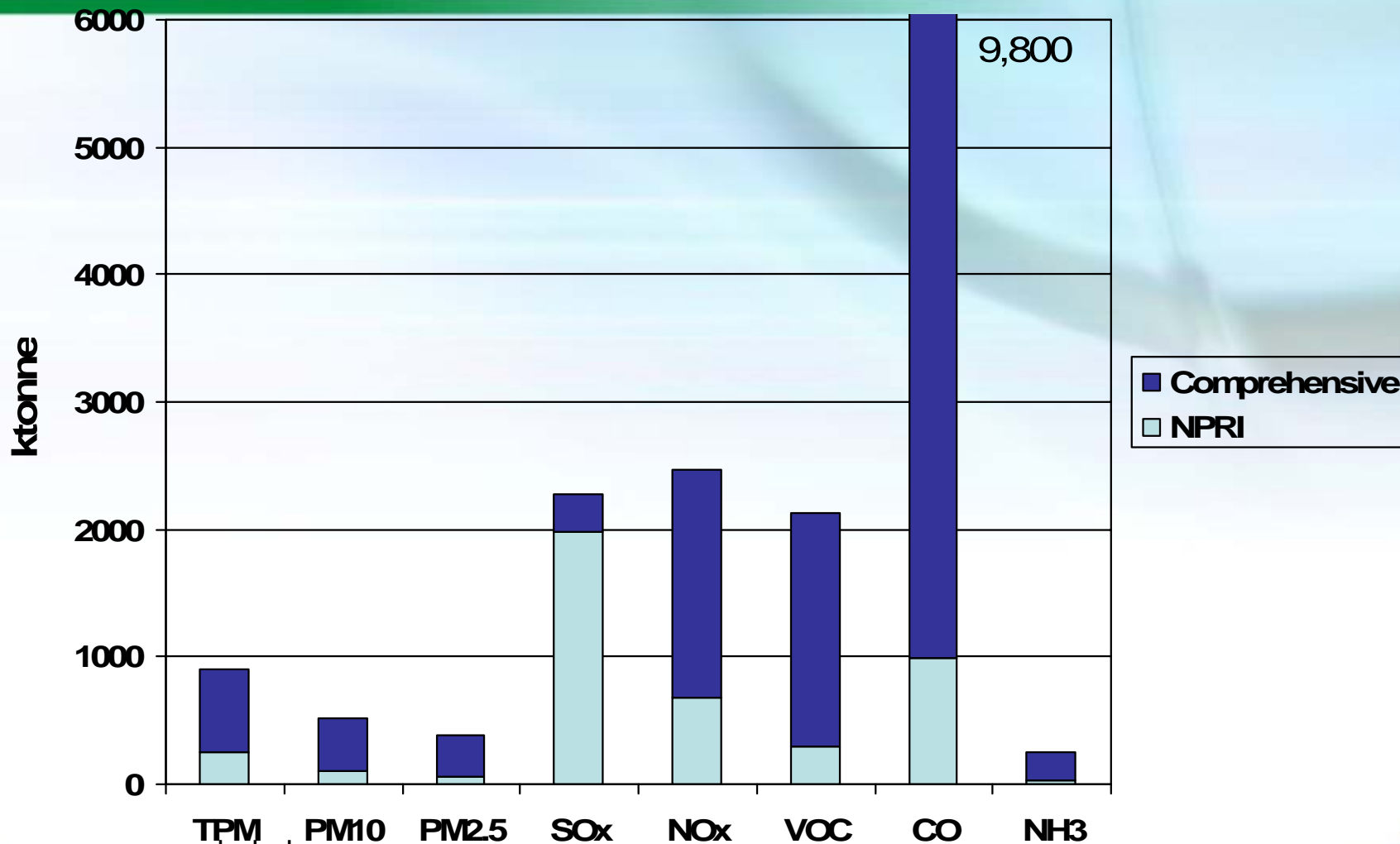


Comprehensive Emissions Inventories

Account for the emissions (small, medium and large sources) from:

- **Point Sources (Industrial/Commercial activities)**
 - Industrial/commercial facilities, obtained from federal and provincial surveys (NPRI).
- **Power Generation (large and small)**
- **Area Sources (sources that are too numerous or too small to be accounted for individually)**
 - Commercial / industrial / domestic activities, residential fuel combustion, dry cleaning, etc.
- **Mobile Sources**
 - On-road and non-road vehicles (passenger vehicles, trucks, buses, trains, aircraft, marine)
- **Open Sources**
 - Forest fires, land erosion/tilling, paved/unpaved road dust, agricultural tilling, etc.
- **Natural/Biogenic Sources (vegetation: crops, forests, soils)**

Contribution of NPRI to the 2002 Comprehensive CAC Emissions Inventory



Open sources excluded.

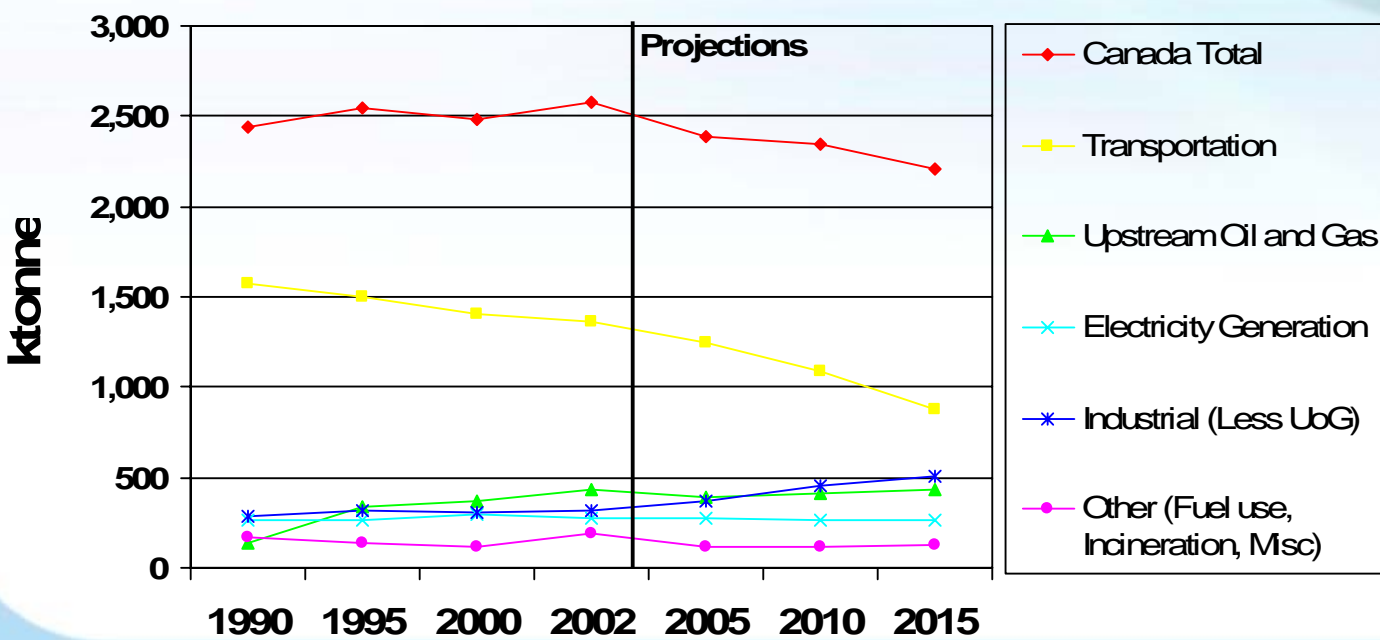


Nitrogen emissions – Canada NOx

- Major Emitting Sectors in 2002
 - Upstream Oil and Gas (11%)
 - Transportation (53%)
 - Electricity Generation (11%)

Criteria Air Contaminants Section
www.ec.gc.ca/pdb/cac/cac_home_e.cfm

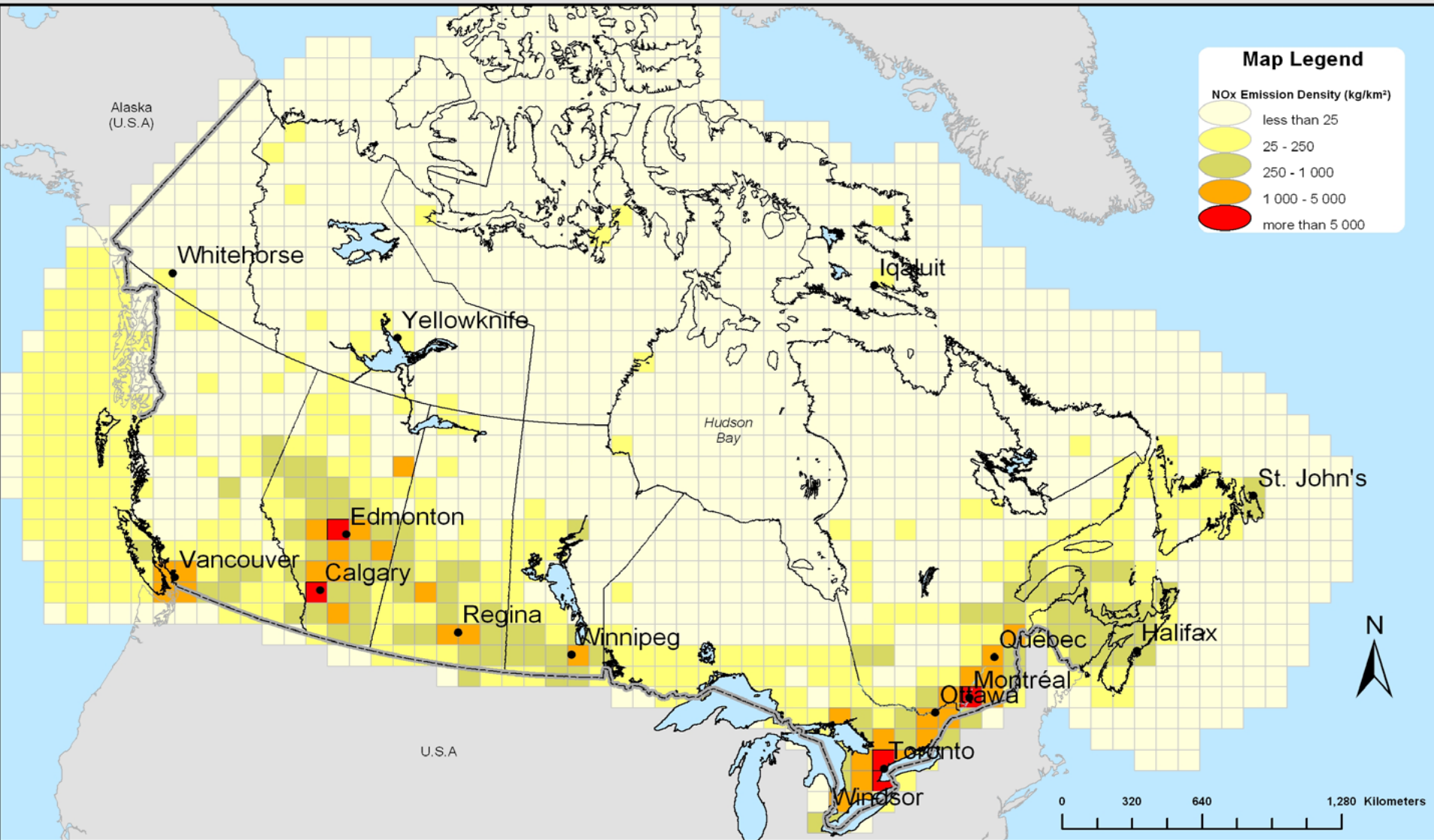
Canada



14% decrease from 2002 to 2015 due mainly to reductions from vehicles and electricity generation

Open Sources Included

NITROGEN OXIDE (NO_x) EMISSIONS IN CANADA FOR 2000



Environment
Canada

Environnement
Canada

POLLUTION DATA BRANCH, NOVEMBER 2005
2000 Criteria Air Contaminant (CAC) inventory updated December 2004

Canada



Environment
Canada

Environnement
Canada

Aug 25, 2006

Page 11

Canada



Nitrogen emissions - Canada NH₃

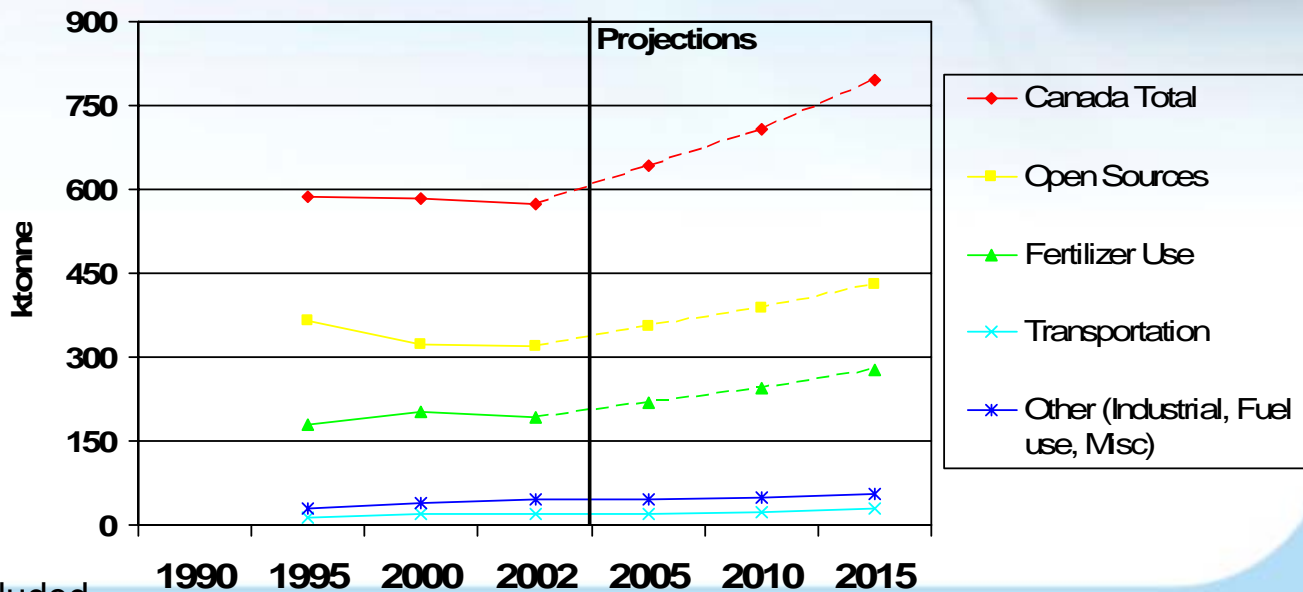
Major Emitting Sectors in 2002

- Agriculture and Fertilizer use (87%)
- Chemical Industry (2%)
- Transportation (3%)
- Projections are Preliminary

Criteria Air Contaminants Section
www.ec.gc.ca/pdb/cac/cac_home_e.cfm

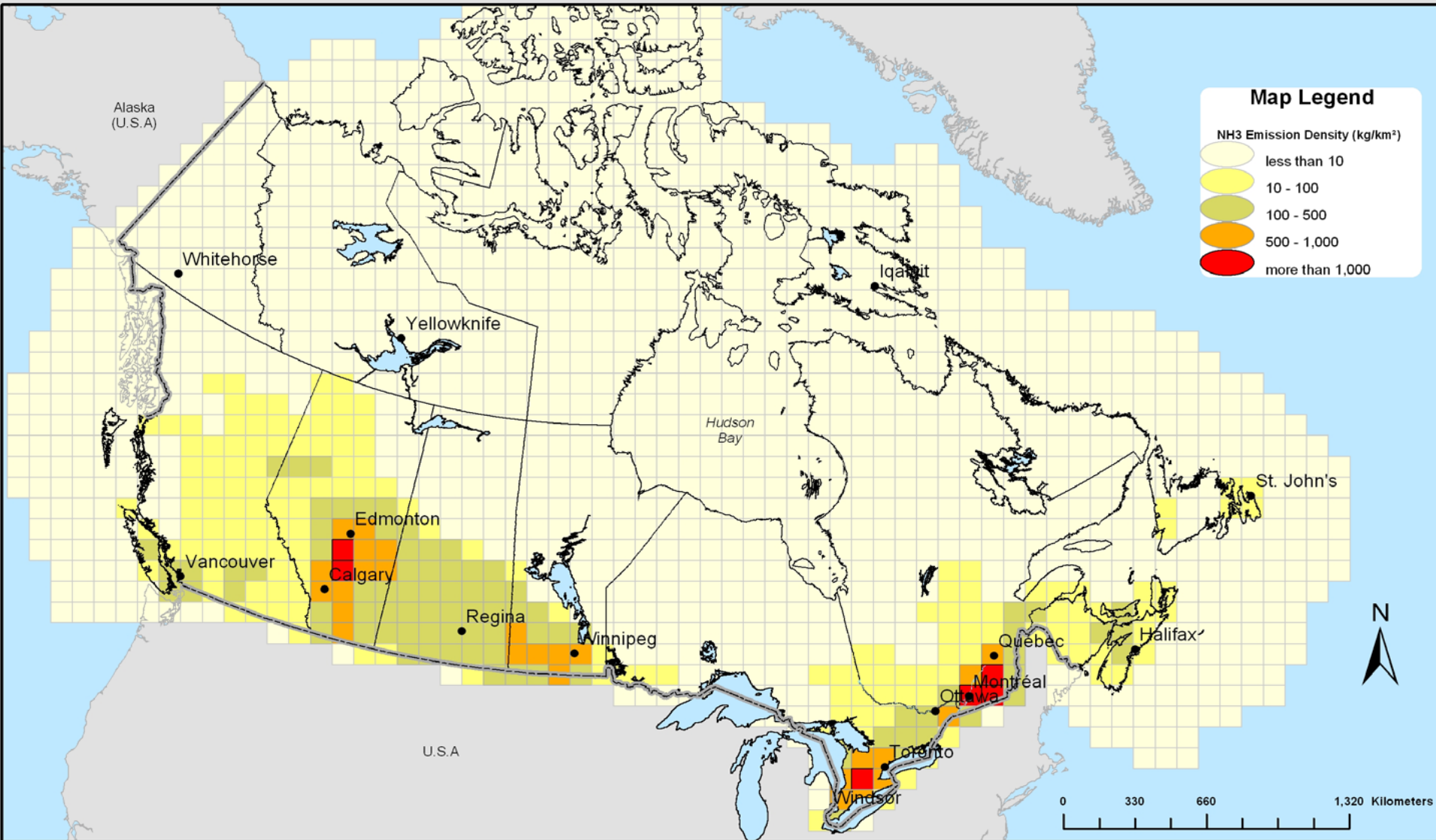
Canada

38% increase
 from 2002 to 2015
 due mainly to
 projection
 methodology for
 Agriculture



Open Sources Included

AMMONIA (NH3) EMISSIONS IN CANADA FOR 2000



Environment
Canada

Environnement
Canada

POLLUTION DATA BRANCH, NOVEMBER 2005
2000 Criteria Air Contaminant (CAC) inventory updated December 2004

Canada



Environment
Canada

Environnement
Canada

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Page 13

Canada

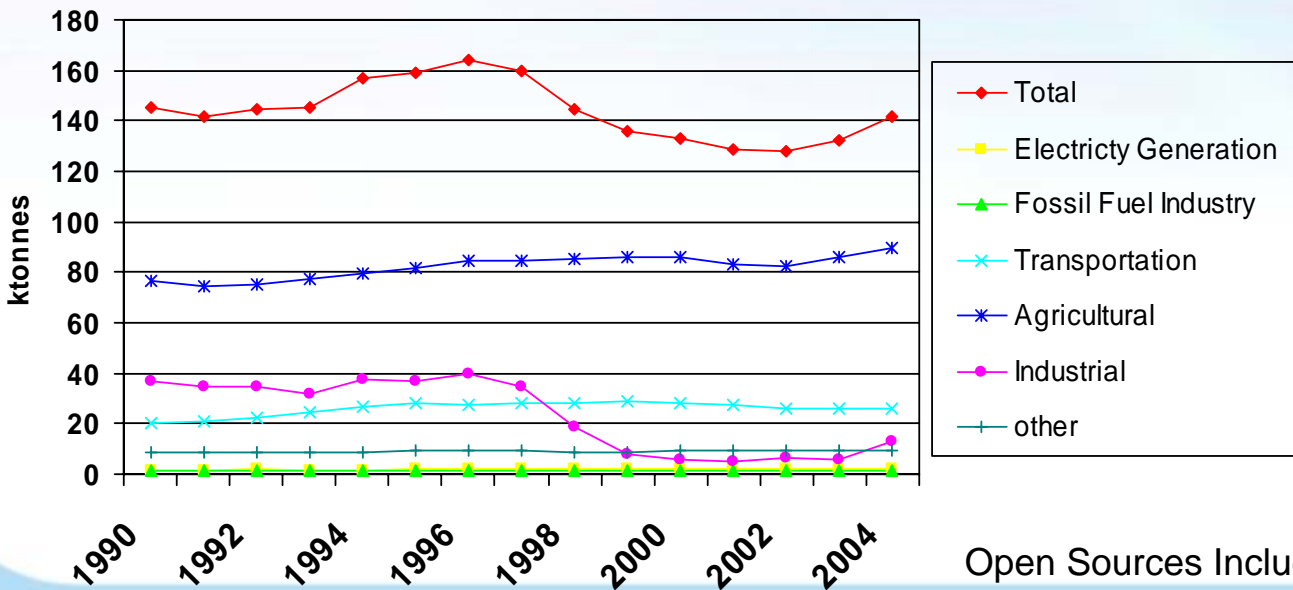


Nitrogen emissions – Canada N₂O

Greenhouse Gas Branch
www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm

- Major Emitting Sectors in 2002
 - Agriculture (64%)
 - Transportation (20%)
 - Chemical Industry (5%)
 - Fuel Combustion (7%)

Canada



Open Sources Included



Nitrogen emissions - Alberta NOx

Major Emitting Sectors in 2002

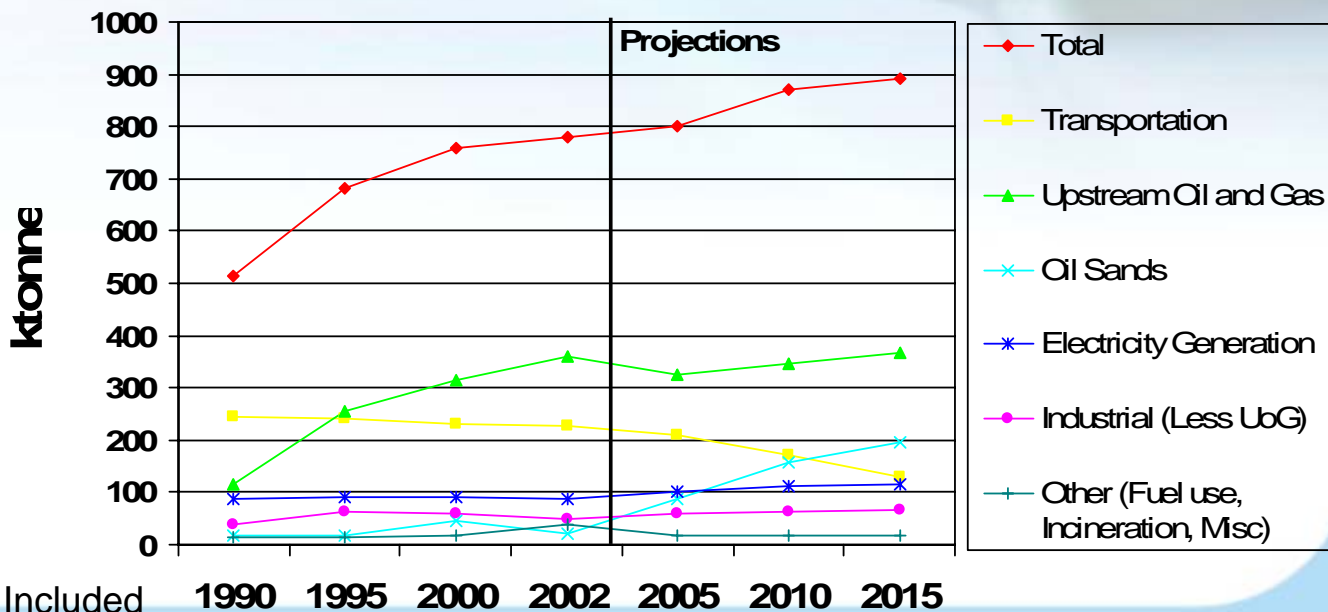
- Upstream Oil and Gas (46%)
- Transportation (29%)
- Electricity Generation (11%)
- CASA forecast used

Criteria Air Contaminants Section
www.ec.gc.ca/pdb/cac/cac_home_e.cfm

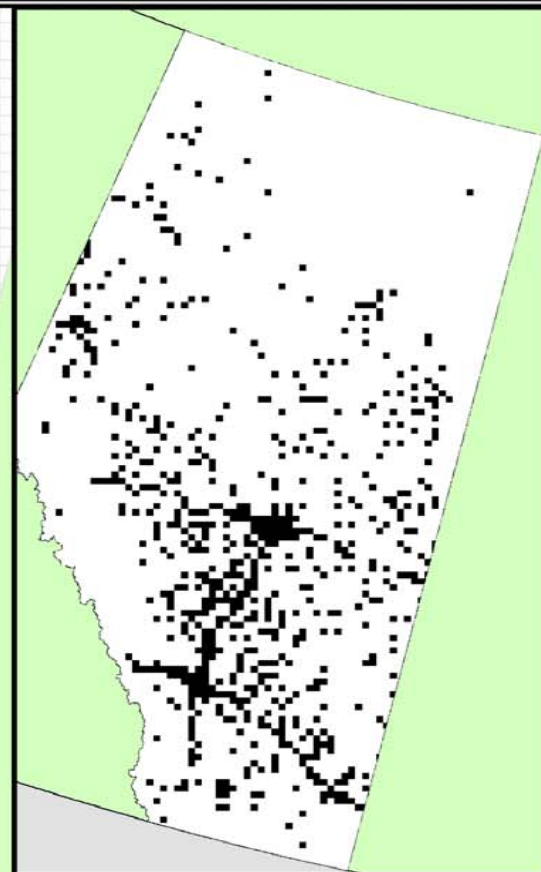
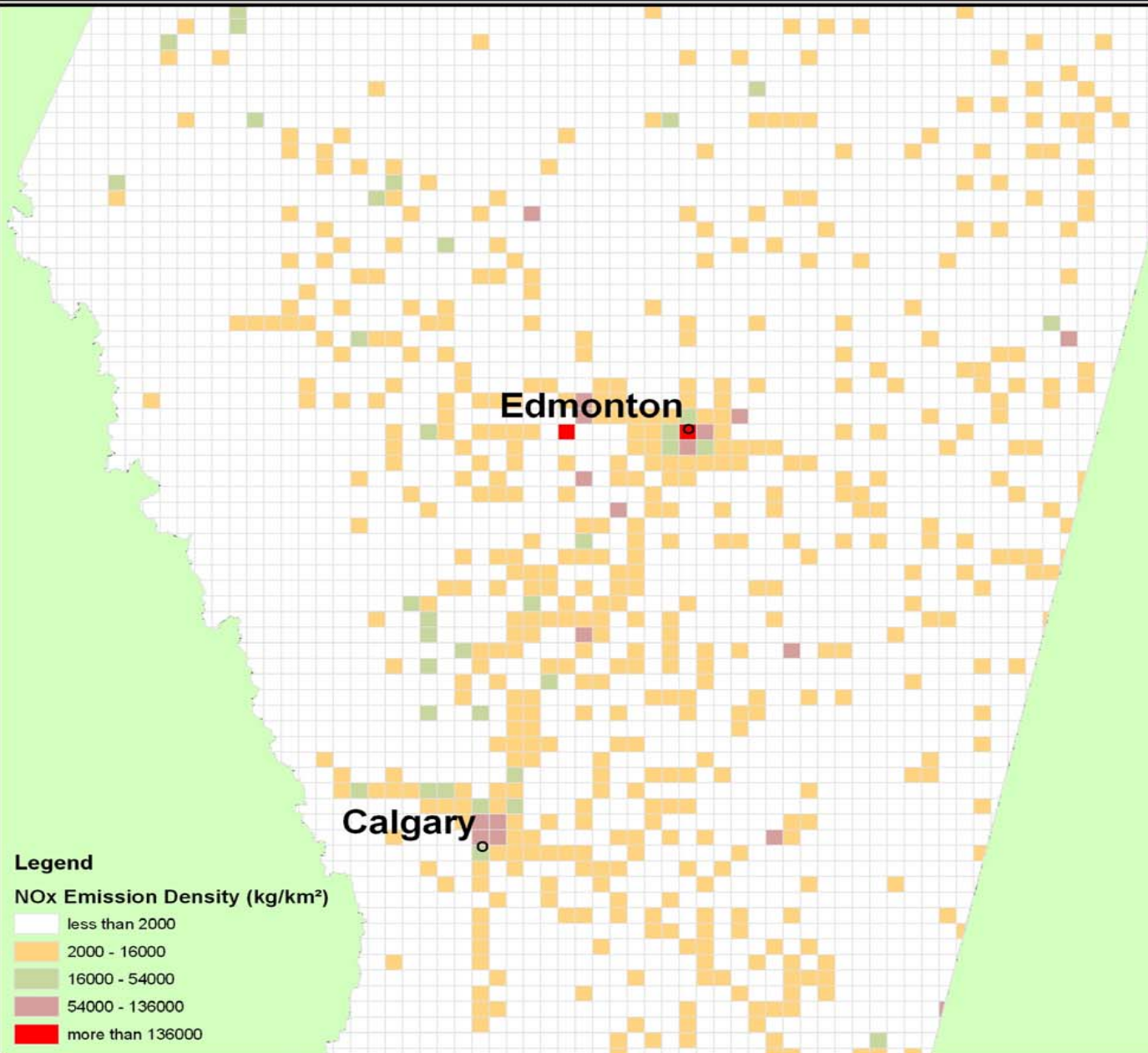
14% increase from 2002 to 2015 due mainly to increases in oil sands, UoG, and some industries off-set by transportation decreases

Open Sources Included

Alberta



NITROGEN OXIDES EMISSIONS IN ALBERTA FOR 2000





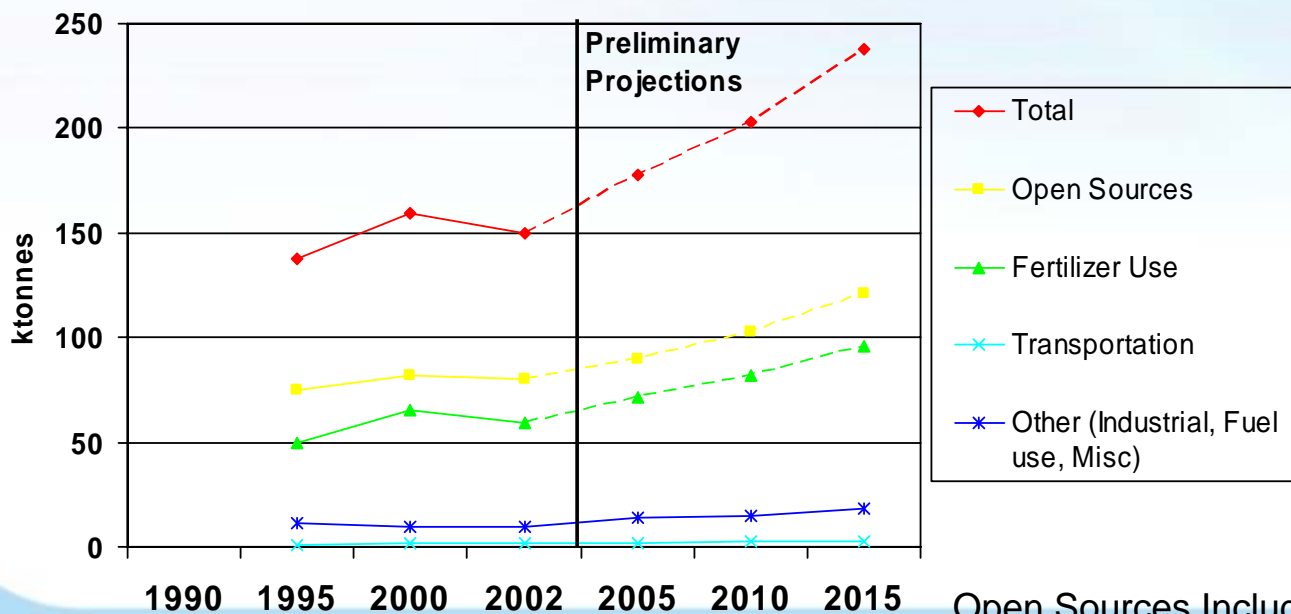
Nitrogen emissions – Alberta NH₃

Criteria Air Contaminants Section
www.ec.gc.ca/pdb/cac/cac_home_e.cfm

Major Emitting Sectors in 2002

- Agriculture and Fertilizer use (91%)
- Chemical Industry (4%)
- Other (Industry, Human, vehicles)
- Projections are Preliminary

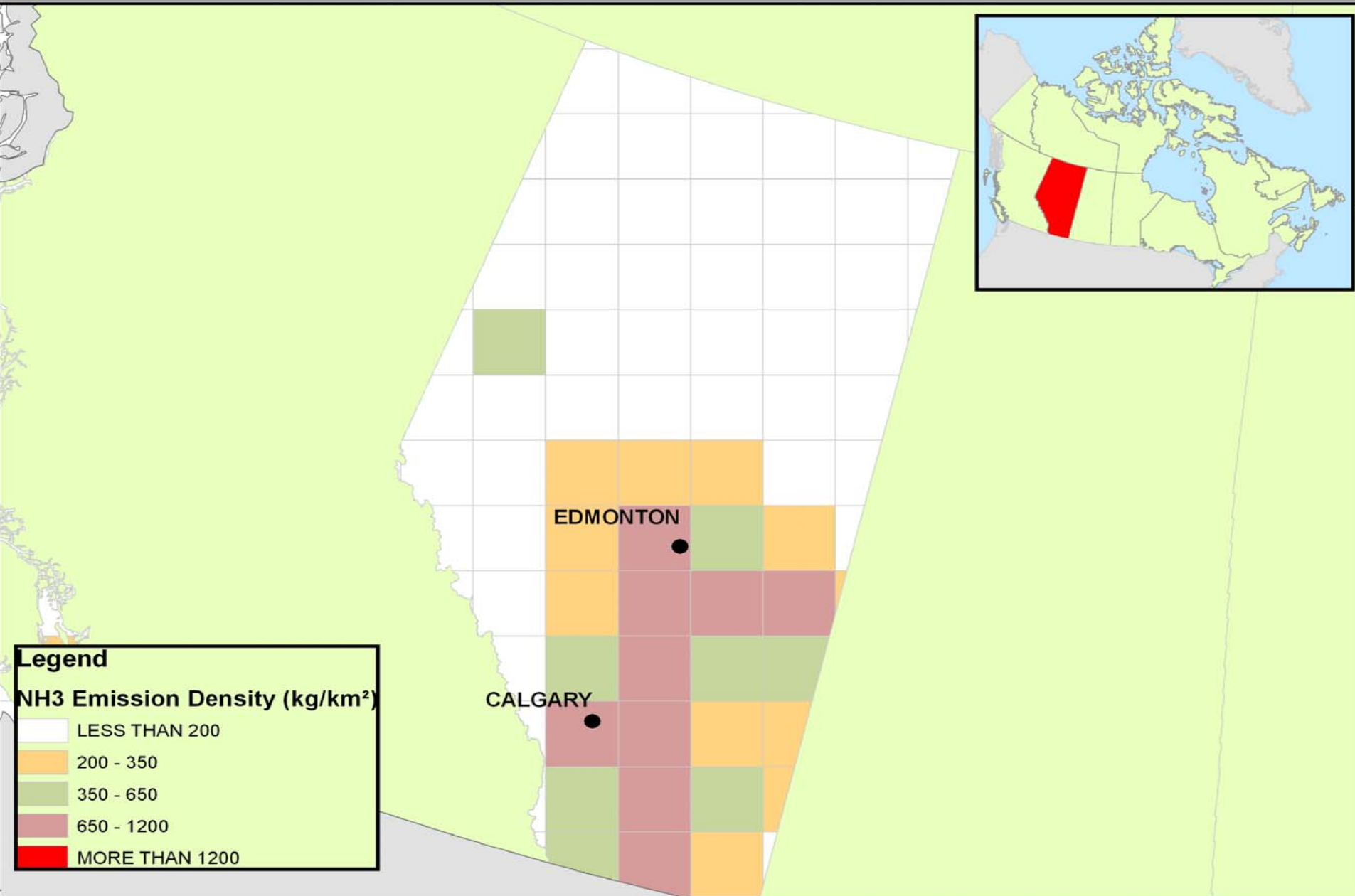
Alberta



Open Sources Included

58% increase from 2002 to 2015 due mainly to projection methodology for Agriculture

AMMONIA EMISSIONS IN ALBERTA FOR 2000



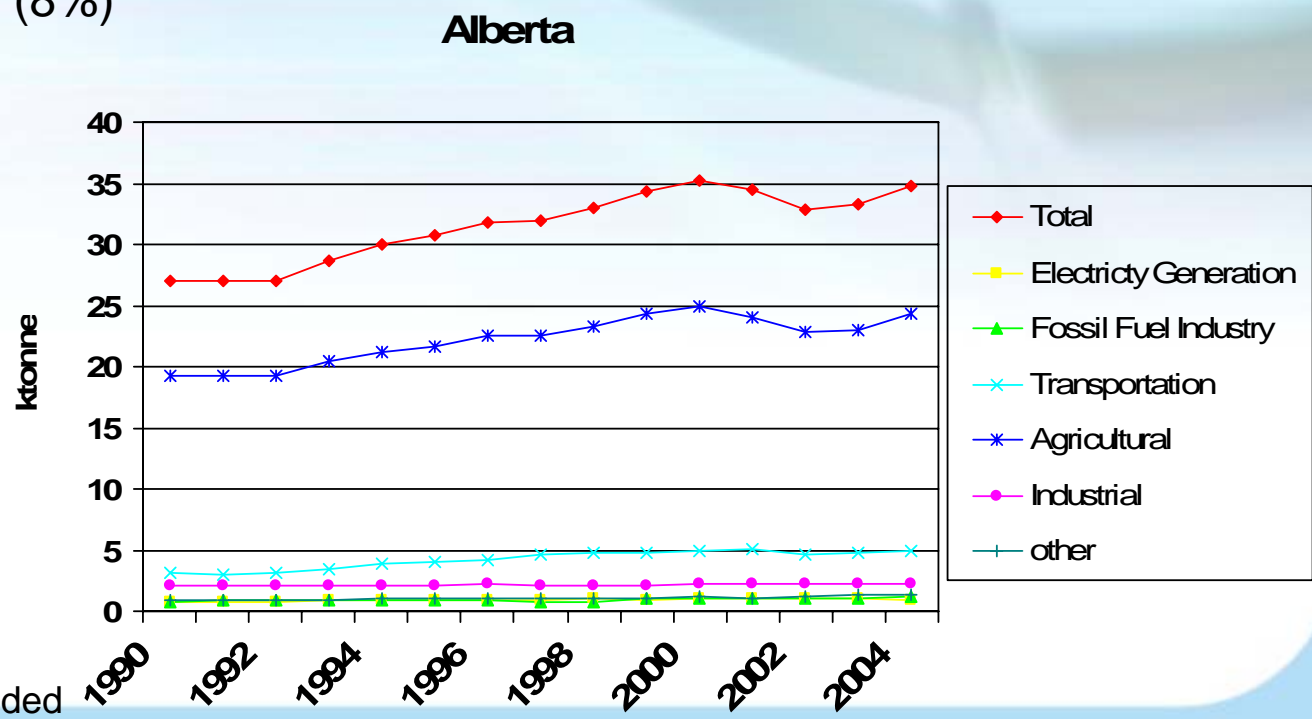


Nitrogen emissions - Alberta N₂O

Major Emitting Sectors in 2002

- Agriculture (69%)
- Chemical Industry (7%)
- Transportation (14%)
- Fuel Combustion (8%)

Greenhouse Gas Branch
www.ec.gc.ca/pdb/ghg/ghg_home_e.cfm



Open Sources Included



Upcoming Emissions Reduction Activities

Alberta Environment Activities

- Best Available technology economically feasible (BATEA) for industrial NOx.
- In conjunction with CASA
 - PM / O3 Framework
 - Vehicle emissions team
 - Electricity project team
 - Acid Deposition Management Framework

Environment Canada Initiatives

- Environmental Agenda: focus on reductions of CAC, GHG, & Toxics emissions
- Transportation: 5% ethanol.
- Clean Air Act under CEPA: Strengthens EC's ability to address sources of air pollution.



Emissions Inventory Improvements

Upcoming improvements:

- Emissions from fertiliser application
- Ammonia emissions from swine operations
- Emissions from the grain industry, asphalt plants, clay products
- Refined estimates from Iron and Steel and Aluminium Industries
- Spatial allocation of agriculture emissions across Canada using multiple combined datasets
- Enhancement of GIS information to more adequately represent the spatial allocation of emissions
- Surveys: Solvents, Residential Wood Combustion
- Incorporate new emissions projections models
 - Improving ammonia projections
 - Include effects of new reduction measures
 - Co-benefit effect of emissions reductions on other pollutants





CAC Improvement Activities

- Extensive work being done on Agricultural Ammonia emissions with Agriculture Canada
- Surveys: Solvents, Residential Wood Combustion
- Spatial Allocation: refining GIS information to more adequately reflect where emissions occur
- Incorporate new emissions projections models
 - Improving ammonia projections
 - Include effects of new reduction measures
 - Co-benefit effect of emissions reductions on other pollutants



Conclusion

- Generally AB “nitrogen” emissions are increasing
- Further work required to refine ammonia emissions estimates and projections
- Updates required to emissions projections to incorporate new reduction programs

