Emissions from Canada

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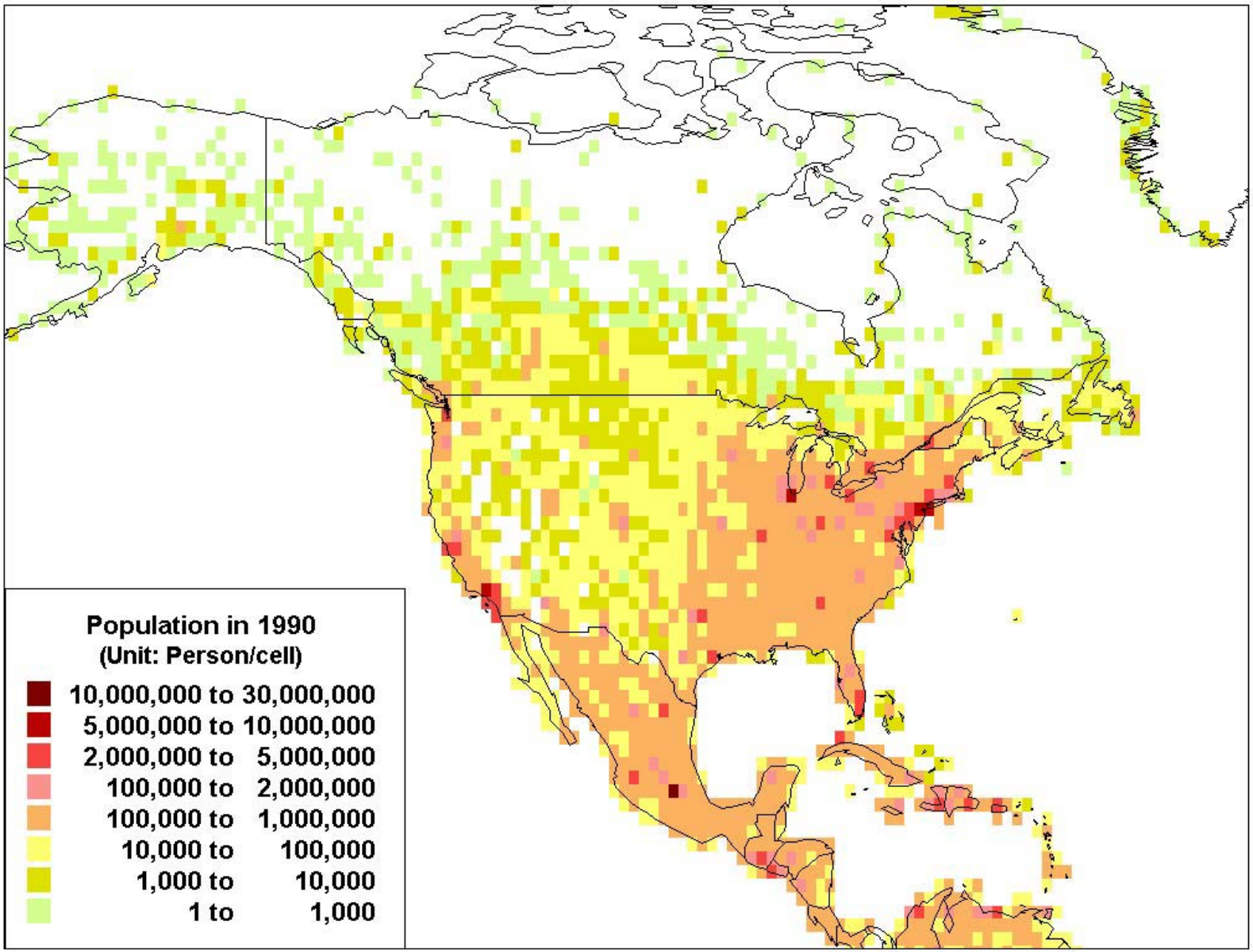
Talk Outline

- Characteristics of Canadian CAC emissions
- Characteristics of Canadian inventories
- Canadian emission trends
- Inventory issues

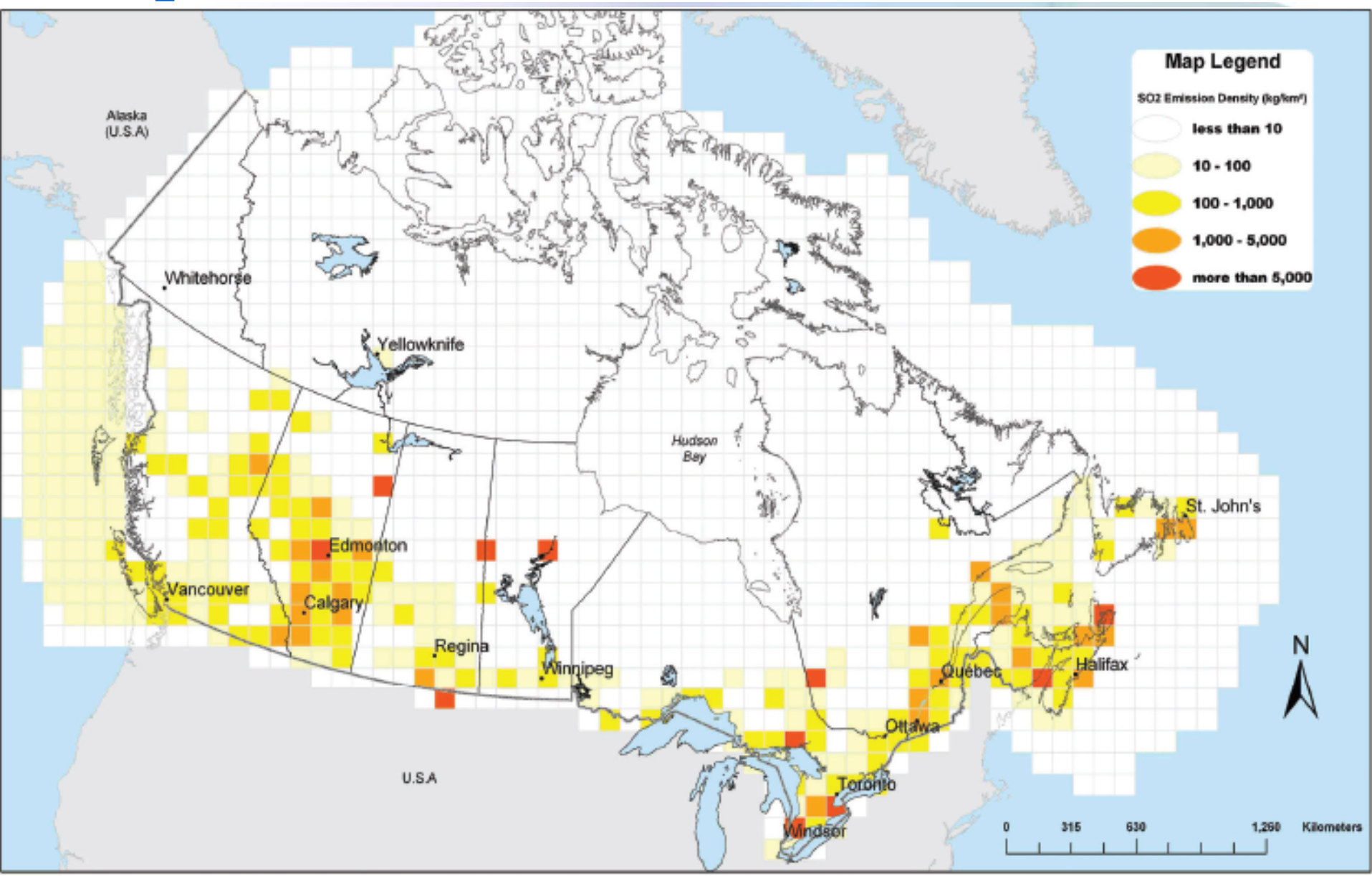
Characteristics of Canadian CAC emissions

- Canada is the second-largest country in the world, but by population distribution, Canada is a very narrow, elongated country with most of its people living close to the U.S. border
- A number of major point sources are located well north of population centres and the U.S. border
- On a percentage basis, power generation is less important in Canada than the U.S., but other industrial sources (especially the smelting and upstream oil & gas sectors) are more important

1990 North American population density, 1°x1° (Src: GEIA)



SO_2 Emission Density in Canada for 2000 (kg/km^2)



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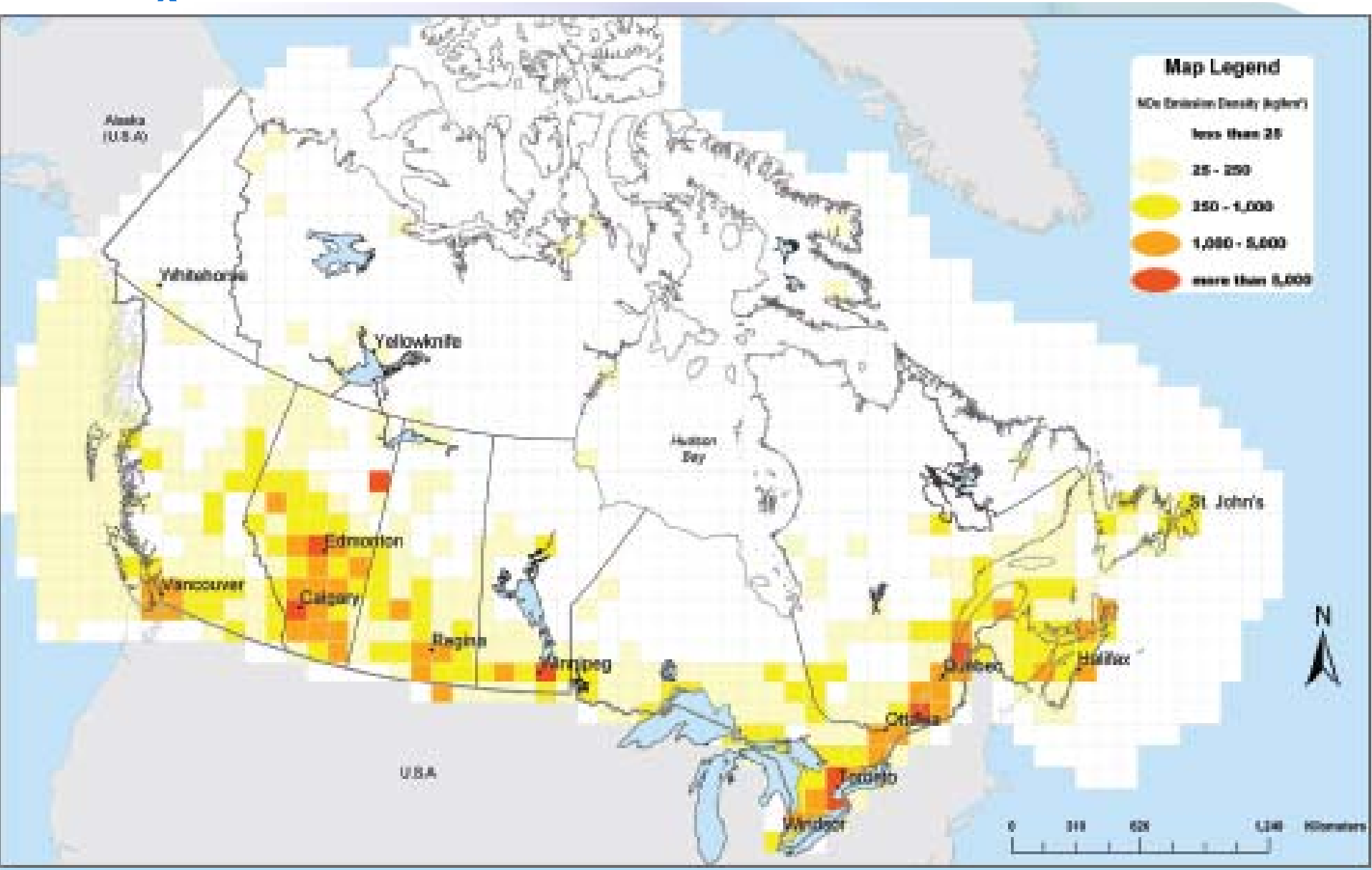
[Source: *2004 Canadian Acid Rain Science Assessment*]

NO_x Emission Density in Canada for 2000 (kg/km^2)



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[Source: *2004 Canadian Acid Rain Science Assessment*]

Canada/U.S. % of Key Emissions by Sector (1999)

Sector	SO_2		NO_x		VOCs	
	U.S.	Canada	U.S.	Canada	U.S.	Canada
Electrical Utilities	67	25	23	12	-	-
Fuel Combustion	18	18	17	19	5	14
Industrial Sources	8	53	4	11	44	46
Transportation	7	4	55	56	47	23
Other	< 1	< 1	1	2	4	17

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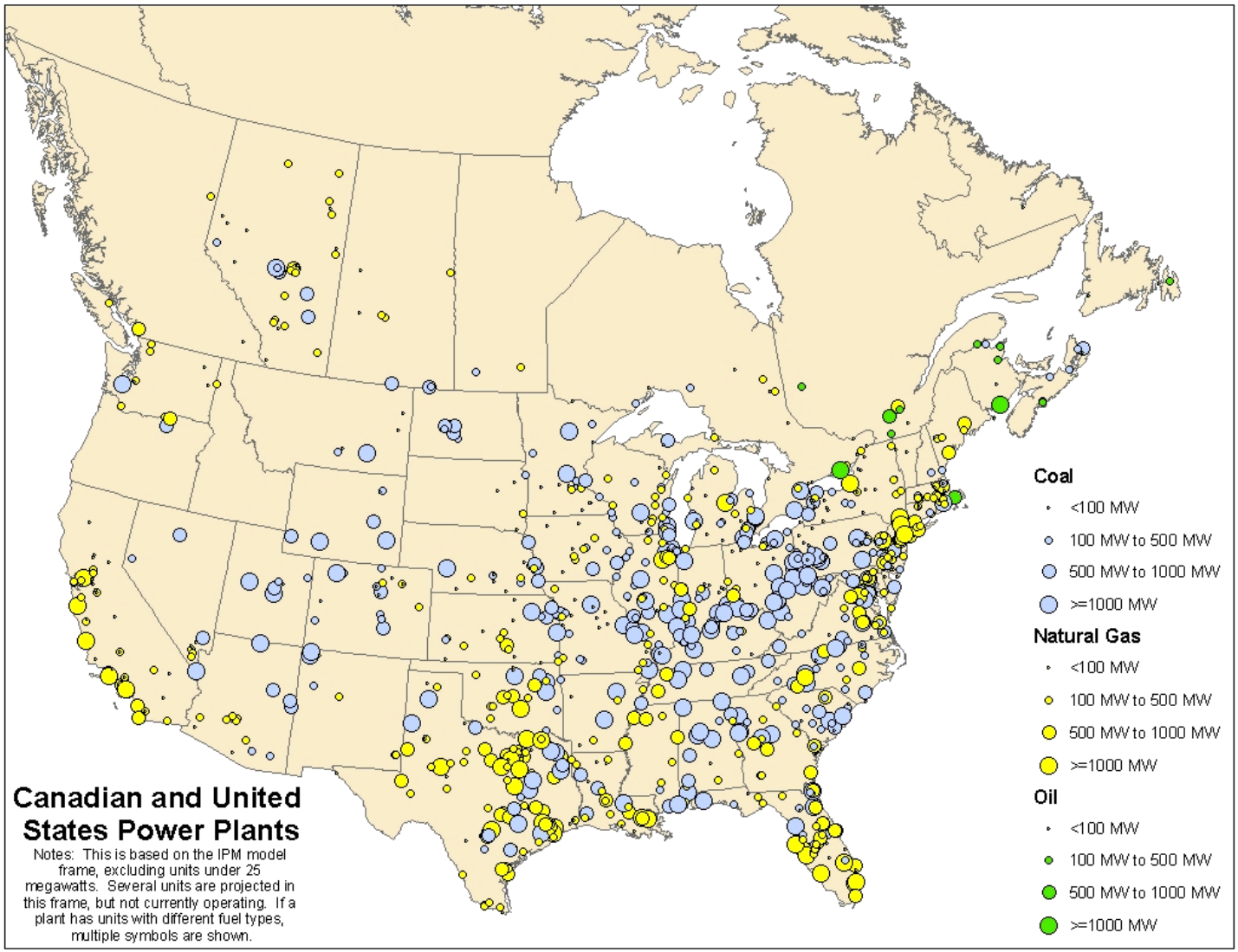
(Source: www.epa.gov/airmarkets/usca/brochure/working_chart.htm)

Types of Canadian & U.S. Power Plants

	Percentage Contribution to Electricity Generation			
Country	Hydroelectric	Fossil Fuel	Nuclear	Other
Canada (1998)	59	29	12	<1
U.S. (2000)	7	71	20	2

[Source: *www.nationsencyclopedia.com/Americas*]

Location of Cdn & U.S. Thermal EGUs



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[Src: *2005 Canada-U.S. Emissions Cap & Trading Feasibility Study*]

Characteristics of Canadian inventories

- Inventory types: CAC, HAP, GHG
- CAC inventory years: 1985, 1990, 1995, 2000, 2002, 2003, 2004, ...
- CAC inventories compiled by Environment Canada in collaboration with provinces/territories, though with big change from 2000 to 2002
- 1990, 1995, and 2000 inventories have been provided to U.S. EPA using EPA file formats but with restrictions on point sources

National Pollutant Release Inventory (NPRI)

- Canada's national pollutant release and transfer registry (similar to U.S. EPA's TRI)
- Collects facility-level pollutant release data annually
- Initiated in 1993 by Environment Canada (EC)
- Over 300 substances declared toxic under Canadian Environmental Protection Act (CEPA), including PM and ozone precursors (i.e., SO_2, NOx, VOC, NH_3, CO) as of 2002 inventory

Point source reporting

- Before 2002, CAC point-source emission data at process level were supplied to EC by provinces, but with confidentiality restrictions
- Beginning with 2002 NPRI inventory, facilities report facility-level CAC emissions directly to NPRI, with emissions from tall smokestacks (> 50 metres) broken out
- Beginning with 2003, speciated VOC emissions also reported at facility and/or stack level

Canadian emission trends

- Relevant legislation and agreements
- Canadian emission trends – past
- Canadian emission trends – forward

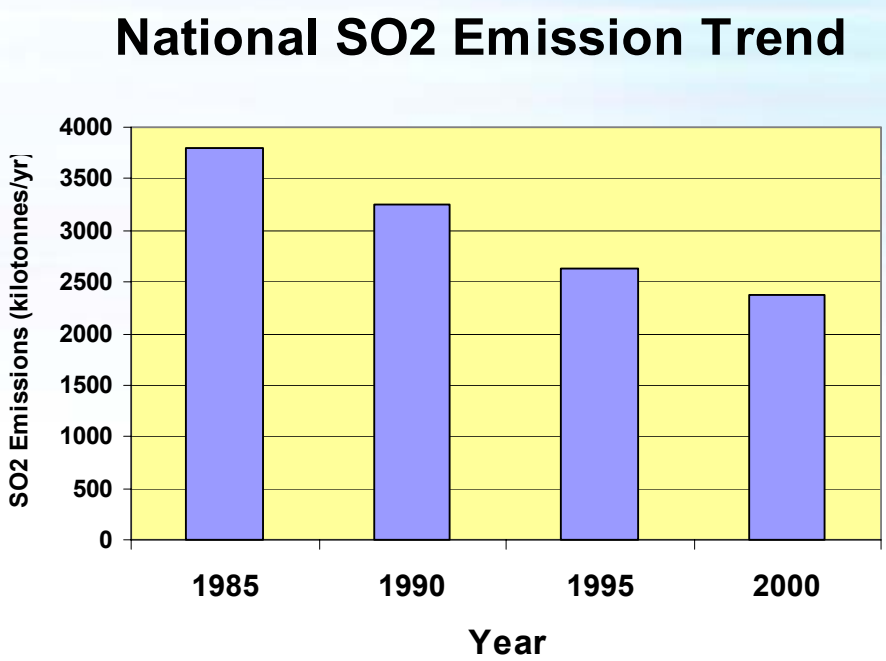
Relevant legislation & agreements (1)

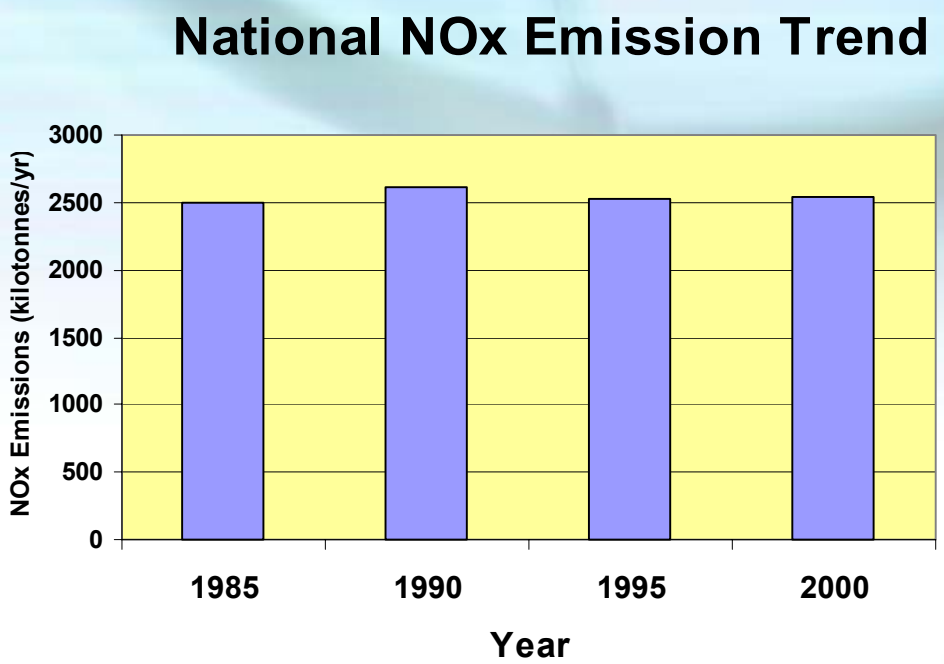
- *1985 Eastern Canadian Acid Rain Control Program*
  - SO_2 emission reduction targets from Ontario east
- *1991 Canada-U.S.A. Air Quality Accord*
  - SO_2 emissions cap of 3.2 million tonnes nationally
  - SO_2 emissions cap of 2.3 million tonnes for eastern Canada
  - NO_x emission reductions
  - PSD and visibility provisions
- *1998 Canada-Wide Acid Rain Strategy for Post-2000*
  - new SO_2 emission reduction targets from Ontario east
  - continuous improvement/keeping clean areas clean

Relevant legislation & agreements (2)

- *1999 Canadian Environmental Protection Act*
  - renewal of *1988 CEPA:* includes
  - collection of emissions data for inventory preparation (NPRI)
  - clean vehicles and clean fuels
  - pollution prevention plans
- *2000 Canada Wide Standards for PM and Ozone*
  - emission reductions by provinces to achieve standards by 2010, including point sources

Canadian emission trends – past





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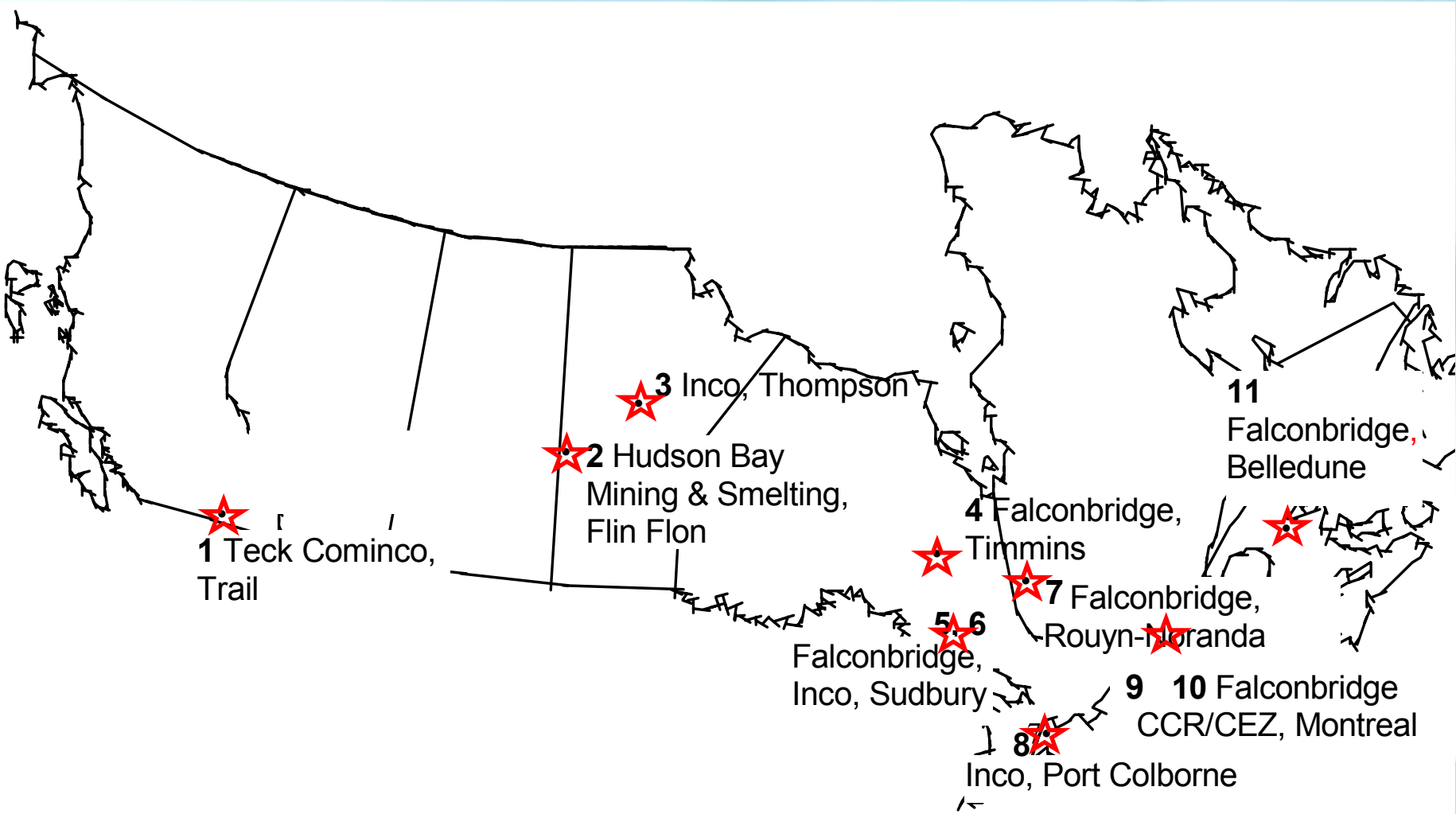
[Source: *2004 Canadian Acid Rain Science Assessment*]

Canadian emission trends – forward

- New emission targets were announced for SO_2 emissions from base metals smelters in all provinces on 29 April 2006 in *Canada Gazette*
- Targets apply to 11 facilities in five provinces
- Target years are 2008 and 2015

Canadian base metals metallurgical complexes



(Left) INCO ,Sudbury, ON and (right) Hudson Bay Mining & Smelting, Flin Flon, MB

Falconbridge Horne smelter, Rouyn, QU

CEPA Base Metals Smelting Pollution Prevention Plan Targets (*Canada Gazette*, 29 April 2006)

	SO2 Emissions (tonnes/year)			
Facility	1995	2002	2008	2015
Teck Cominco - Trail Operation	N/A	3,688	3,400	3,400
Hudson Bay Mining & Smelting	162,000	177,887	187,000	33,500
Inco - Thompson	195,000	196,419	187,000	22,800
Inco - Sudbury	236,000	242,952	175,000	66,000
Falconbridge - Kidd/Timmins	N/A	5,995	7,525	7,525
Falconbridge - Sudbury	45,000	38,300	66,000	25,000
Falconbridge - Horne	172,000	62,180	45,000	43,500
Falconbridge - Brunswick	14,000	8,258	12,700	11,000
Falconbridge - CEZ	N/A	131	6,900	6,900
Total	>824,000	735,809	690,525	219,625

Sudbury SO_2 emissions trend: 1960 to 2015
(sum of INCO and Falconbridge emissions)

Year	1960	1988	1995	2002	2008	2015
SO2 Emissions (Ktonnes/yr)	2560	700	281	281	241	91
Percentage of 1960 Emissions	100	27	11	11	9	4

Source: 1960 and 1988 emissions from Potvin and Negusanti (1995: in "*Restoration and Recovery of an Industrial Region*");
1995 emissions from *1997 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program;*
2002 emissions from 2002 NPRI data base;
2008 and 2015 emissions from *Canada Gazette*, 29 April 2006

Inventory issues (1)

- Point-source confidentiality
  - Before 2002, voluntary CAC reporting by facilities to provinces, provincial reporting to EC was confidential, but could be accessed via a confidentiality agreement
  - replaced by mandatory reporting to NPRI directly starting with 2002 inventory
- Process-level reporting (i.e., by SCC)
  - part of CAC reporting until 2000
  - not required for NPRI reporting (although reporting of operating schedules. tall-stack emissions and stack parameters, and facility-level speciated VOC was added to NPRI)

Inventory issues (2)

- Reconciliation of 2000 and 2002-2004 emissions
  - very difficult without process-level reporting
  - consultations with NPRI stakeholders ongoing for process-level details
- Harmonization (federal/provincial, Cda/U.S.)
  - some provinces (QU, ON, BC) still have their own reporting requirements for facilities
  - good harmonization with U.S. inventories (e.g., use of AP-42, same definition of VOC, SCC coding, SMOKE-ready format), but lack of process-level data and treatment of VOC speciation are issues for new (post-2000) inventories

Inventory issues (3)

- CEM data
  - some but not all provinces require CEM reporting for EGUs
  - CEM data are not available in national inventory
- Emission factors
  - Lack of or outdated PM EFs for some sources
  - Lack of condensable PM measurement methods
  - Unrepresentativeness of some EFs for Canadian conditions (e.g., pulp & paper sector)

Thank you!