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Release of Pollutants in the Great Lakes Basin in Canada

Mitali De
School of Business & Economics, Wilfrid Laurier University
75 University Avenue West, Waterloo, Ontario, Canada, N2L-3C5
mde@wlu.ca

Kanai De
Environmental Advisor/Consultant, Senior Engineer (retired) Environment Canada, Environmental Protection Branch, Toronto ,Ontario, Canada.
kanailalde@gmail.com; kende2@hotmail.com

Abstract – Under the section 46 of Canadian Environmental Protection Act, CEPA, 1999 Canada is required and obligated to gather, process, and publish publicly the national emission summaries for the criteria air contaminants (CAC), heavy metals and persistent organic pollutants (POP) that affect human health and the environment (e.g. water pollution, acid rain, greenhouse gas (GHG) and global warming). Release of such pollutants in the Great Lakes Basin (GLB) is of paramount importance as they affect water quality, fish habitat, aquatic life in the Great Lakes and human life for both Canadians and Americans living in GLB. The objective of this study was to analyse data from Environment Canada's National Pollutants Release Inventory (NPRI) only, relevant to Ontario and Quebec corridor in the GLB that would impact the Great Lakes. These emissions were from stationary industrial sources in Ontario and Quebec provinces and did not include any US industrial sources (e.g. no data from the US sources such as NRI-National Release Inventory or USEPA was included). Analysis presented in this paper, was focused on releases of major criteria air contaminants (CAC), water and land pollutants during the period of 2005-2009. It identified their relative significance (by priority), their general declining trends with some exceptional releases from specific industry sectors. These findings explained the impact of regulations/policies and highlighted the sectors that required priority for pollution prevention (P2) initiatives for Environmental Protection under CEPA.

Keywords**:** NPRI (National Pollutants Release Inventory), CAC (Criteria Air Contaminants), P2 (Pollution Prevention), Great Lakes Basin (GLB).

1. Introduction

The objective of this study was to analyze the data for the priority chemicals that have been released in the Great Lakes Basin. This was conducted by gathering data (EC-NPRI,2005-2009) of emission into air, water and land from Environment Canada's National Pollutants Release Inventory (NPRI) in the Great Lakes Basin in Ontario and Quebec during the period of 2005-2009 (latest at the time of study). A trend analysis over these years is conducted to recognize the priority chemicals from both air emissions and water discharges. This study facilitated the identification of the priority chemicals that need further review of releases in the Great Lakes Basin for the pollution prevention (P2) and elimination of such chemicals in the future.

2. Research Study

2.1. Background

As this data analysis is focused only on Environment Canada NPRI data, it is necessary to mention the limitations of EC - NPRI reporting requirements such as:

1) Employee Thresholds - companies with a total of 20,000 man-hours per year or more need to report emissions or discharges, thereby excluding SMES to report.
2) At least one of 230 substances needs to meet the quantity thresholds and for any specific thresholds refer to NPRI website for details.
3) NPRI covers now about 300 substances releases into all media (e.g. air, water, on site /offsite disposal, accidental releases/spills, land disposal etc.) as long as the thresholds are met.

4) The major substances of concern in the Canadian Great Lakes Basin (EC 2005-2009) are 12 Tier I toxic chemicals (PCB, Mercury, Dioxins/Furan, HCB/29PAHs, pesticides, VOCs, and criteria air contaminants (CACs) such as COx, NOx, SOx, total particulate matter (TPM), PM2.5 and PM10 and other emerging chemicals.
5) This analysis was concentrated on major pollutants or substances released in air shed, waterways and land in the great Lakes Basin in Canada only (mostly in the provinces of Ontario and Quebec). No US EPA release data (e.g. ARI) was included.
6)

3. Results and Discussion

3.1. Criteria Air Contaminants (Cacs) Or Pollutants Emission Into The Great Lakes Basin (GLB) Air Shed During 2005-2009 Are Presented In Fig.1 Below:

Yearly total of CACs (total of SOx, NOx, CO, VOCs, Total Particulate Matters -TPM, PM2.5 and PM10) declined from 850Kt in 2005 to 600Kt in 2008 steadily and sharply to 390Kt in 2009. Sharp decline during 2008 onwards is believed to be results of strict Federal and provincial air regulations, stricter guidelines and standards and mandatory Pollution Prevention (P2) and emission control programs. The composition of CACs did not change from year to year, such as major component SOx was 54-56%,NOx was in the range of 13-15%, CO -12-14% VOCs 8%, Total PM around 5% , PM10- 3% and PM2.5 around 2% of total CACs emission. PM 2.5 fine particulates in the air is of serious health concern. Our findings in GLB are in general agreement with NPRI reported for the provinces of Ontario and Quebec for 2009.

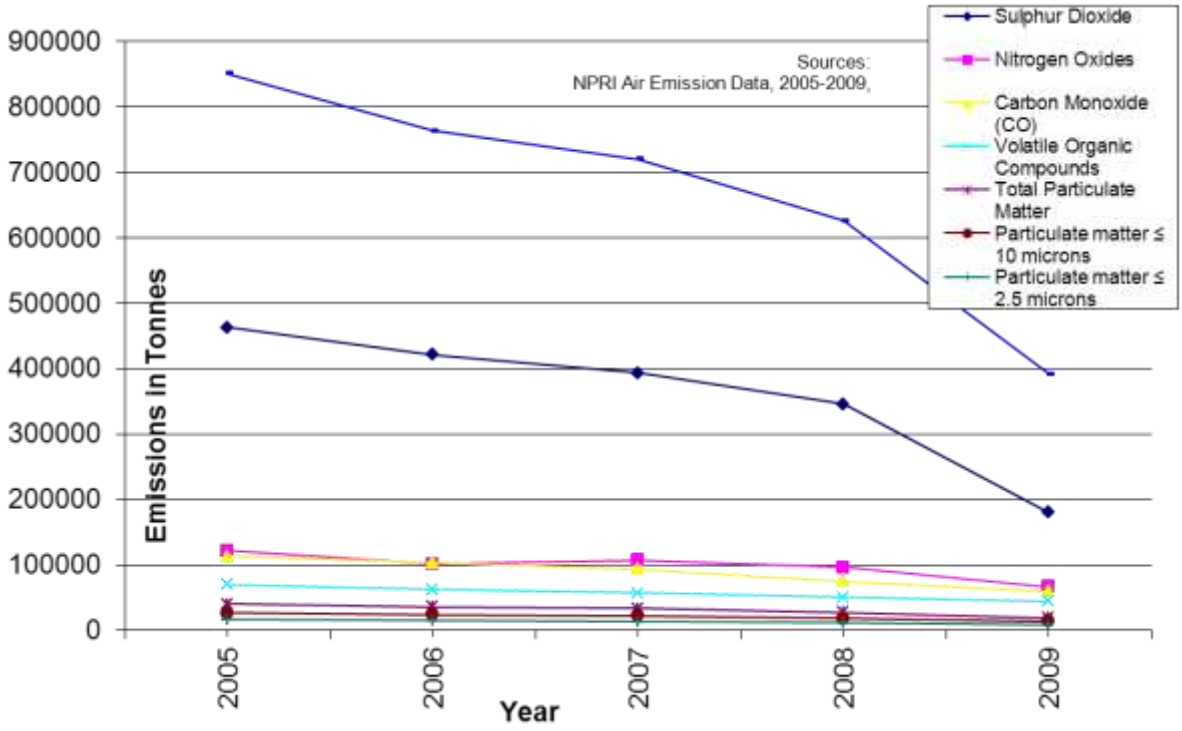

Fig.1. Emission of Criteria Air Contaminants in GLB, Ontario during 2005-2009.

3.2. Total Pollutants Released During 2005-2009 In Various Media In The GLB

Total releases in air and water declined steadily from 2005 to 2008 in the Great Lakes Basin (GLB) due to several programs and initiatives from both federal, provincial and local municipal governments, community and citizen's groups, NGOs and several voluntary/mandatory agreements between US and Canada e.g. Canada-US Binational Toxic Strategy which targeted virtual (90%) elimination of TIER I 12

substances including PCB, Mercury, Dioxin/Furan, PAHs, HCBs, Pesticides etc. Refer to the Fig.2 below.

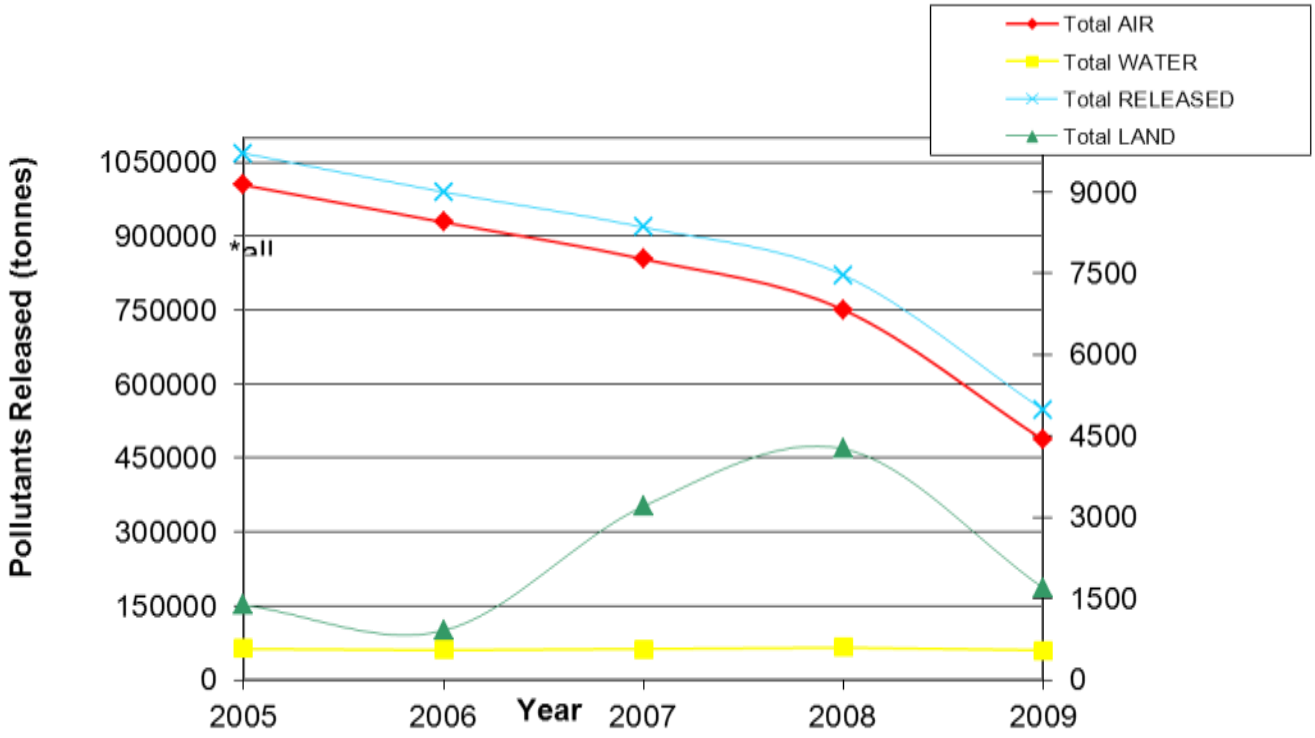

Fig.2. Total Pollutant Releases in the Great Lakes Basin during 2005-2009.

However, sharp decline between 2008 to 2009 onwards is believed to be due to primary impact of several federal, provincial regulations on both sides of the border including, Mandatory P2 planning and implementation, stricter effluents Regulations and Air emission control, Motor Vehicle Emission testing and monitoring, ban or reduction of Phosphorous(nutrients), pesticides, several amended regulations for effluents discharges and Regulation under the Fisheries Act banning or limiting discharge of toxic substances into Canadian waterways etc.

3.3. Water Pollutants Releases Into Waterways Of The Great Lakes Basin During 2005-2009:

The major water pollutants in Ontario Great Lakes Basin are in the following order of magnitude (refer to Fig.3)

PERCENTAGES OF TOTAL RELEASED

ONTARIO	**2005**	**2008**	**2009**
1) Nitrates Ions:	62%	71%	65%
2) Ammonia (total)	35	26	45
3) Phosphate (total)	2	2	2
4) Other Toxics	1	1	1
Total Kilo Tonnes (Kt.):	104.5	106.4	49.8
QUEBEC (Pollutants differed in compositions as shown below)			
1) Ammonia	89%	87%	89%
2) Phosphorous	7	7	7
3) Nitrates	NR	3	2
4) Manganese & compounds	2	2	1
5) Other Toxics	2	1	1
Total Kilo Tonnes (Kt.):	8.34	9.6	9.5

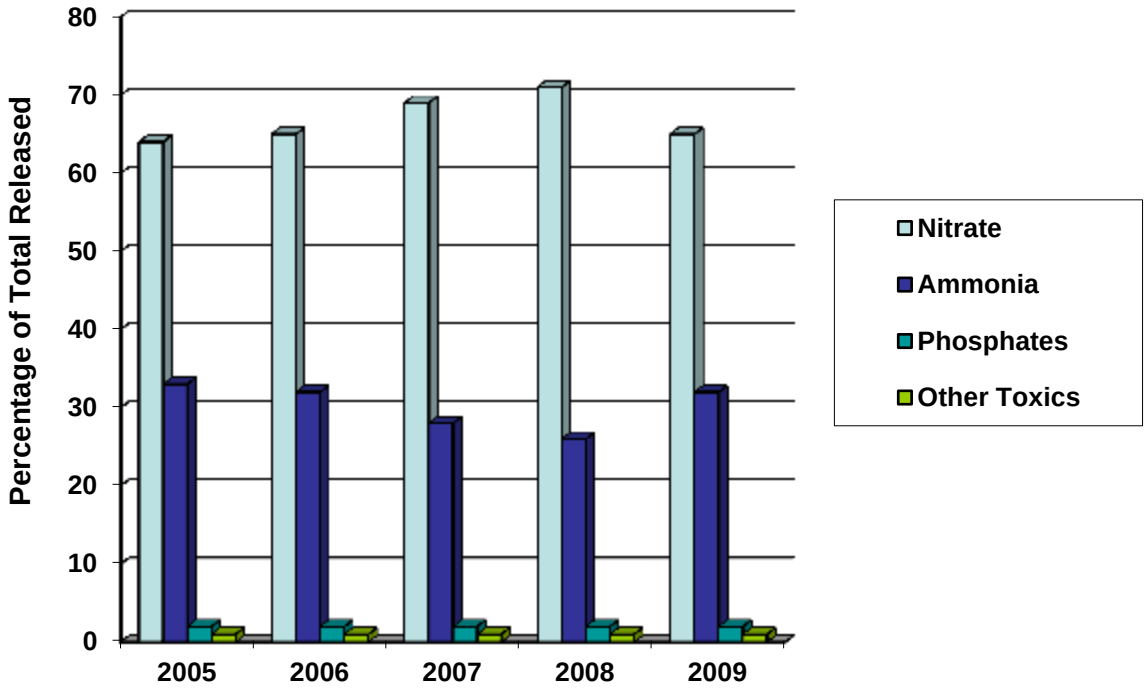

Fig.3. Major Pollutants in Ontario Waterways in the Great Lakes Basin during 2005-2009(as % of Total)

Water pollutants releases are very characteristic of the types of industries that operate and their effluent characteristics. e.g. in Quebec most of the effluents comes from pulp and paper, cement, mining, metals and ores processing and other resources based industries, where as in Ontario mostly from manufacturing, mines, iron and steel mills, non-ferrous smelting (Nickel belts in Sudbury etc.)

3.4. Carbon Dioxide (CO2) Emission Changes In Canada During 2005-2010:

Refer to Fig.4 -Adopted from Environment Canada NPRI Report 1990-2010 & Executive summary files- (EC-NPRI 2005-10 and Web-1 2013).

Total amount of CO2 emitted is reduced by 48 Mt between 2005 and 2010 in Canada, mostly from electricity generation (- 22.5%), manufacturing (-16.6%) fossil fuel and agriculture. However, CO2 emission due to transportation increased by 6.6Mt (+) due to higher volume of motor vehicles use and on road transport trucks. Canada had recently implemented several Fuels Regulations with reduction of sulphur in diesel and gasoline and mandatory emission testing for automobiles and transport trucks.

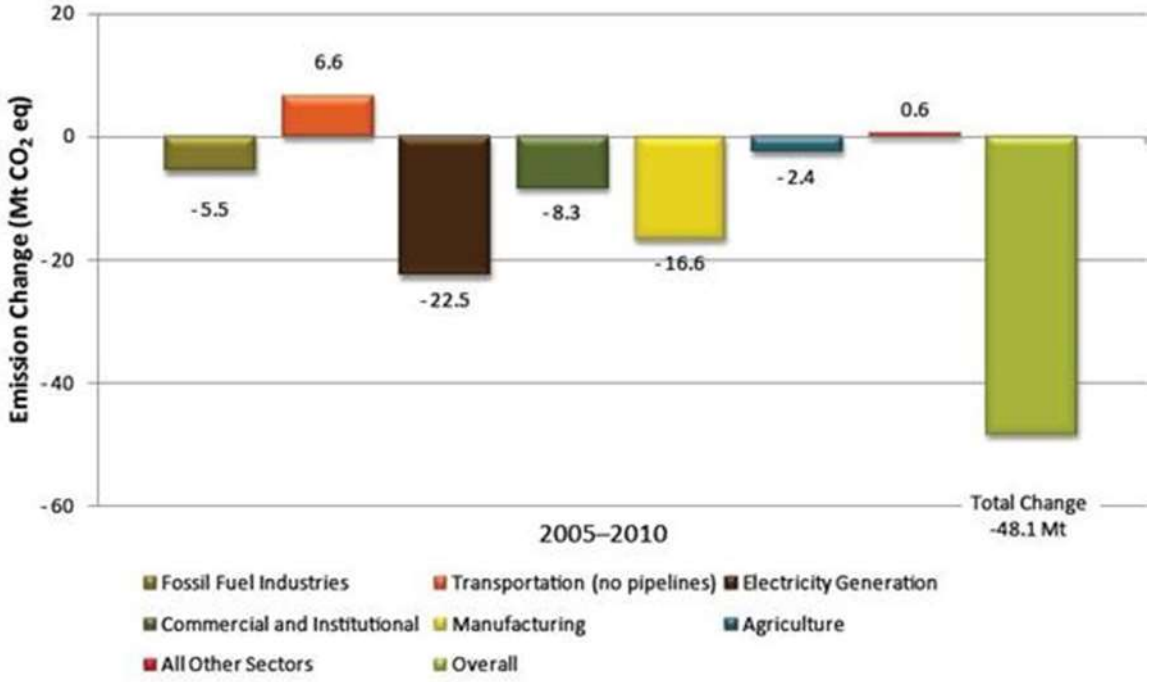

Fig.4.Total CO2 change in Canada during 2005-2010.

4. Conclusion

Our study was focused on the releases of NPRI reported toxics in Ontario and Quebec for the Great Lakes Basin during the period of 2005-2009. In Canada pollutants in all media-air, water and land are declining but at various rates for various provinces. Although CEPA Toxics include some 300 chemicals, this study identified priority air contaminants such as SOx, NOx, CO, C02, VOCs, particulate matters (total, PM2.5 and PM10).

On water pollution, both in Ontario and Quebec Great Lakes Basin-Nitrate, Ammonia, phosphate, manganese compounds played major components of discharge into Great Lakes Waterways.

According to NPRI report (EC- NPRI, 2010) for toxics releases, total releases of pollutants to air and water fell by 17% (640KT) between 2008 and 2012, but were stable between 2011-12 (1% reduction). Most of these reductions were due to mandatory Pollution Prevention (P2) under CEPA, and several recent provincial regulations particularly in Ontario such as O. Regs 419 (Air), O. Regs 455 (Toxics Reporting), Reduction of CO2 emission from Coal-Fired Generation of Electricity (SOR/2012-

167) and use of alternate renewable energy sources such as high efficiency natural gas, windmills, solar power, energy conservation through energy efficient appliances and electrical retrofit/bulbs etc. Recent CEPA regulations under P2 such as Solvent Degreasing Regulations (SOR/203-283), Phosphorous Concentration Regulations (SOR/89-501 and its amendments, Ban on Pesticides and Virtual elimination of Tier I toxics (PCB, Mercury, PaH, HCBs, Dioxins and Furan (D/F), several voluntary initiatives to reduce toxics by NGO, governments, citizens groups on both sides of the border contributed to declining trends as well.

In the second phase of the study, data available from most recent years (2010-2012) (EC- NPRI 2012, and Web-1, 2013) will be compared with the results of this study to see overall trends and rates of decline (or increase if any and causes) for specific or priority industry sectors (Web-3, 2013).

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Web-3: www.on.ec.gc.ca/greatlakes , 2010-2013