

Environment Canada's Mercury Science Program- Atmospheric Mercury Monitoring

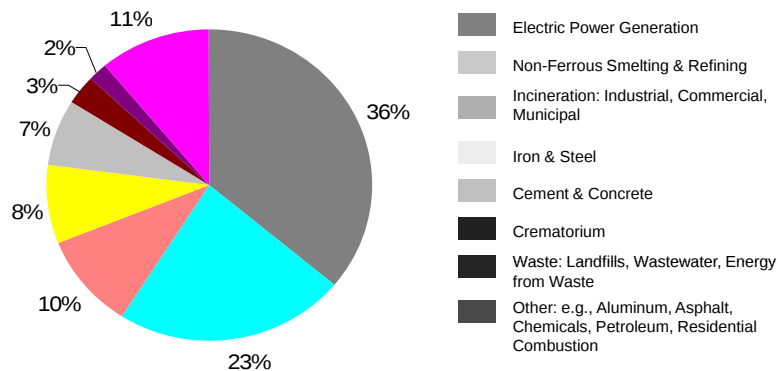
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Why does Canada care about mercury?

- Mercury is toxic to humans and biota at levels found in the Canadian environment.
- Almost every province and territory in Canada posts an annual fish consumption advisory; ~90% of the time, this advisory is the result of high mercury levels.

What are the Canadian anthropogenic sources of mercury to the atmosphere?

2006 Canadian Atmospheric Mercury Emissions Profile (5700 kg*)



* Emissions may increase by 2,000 kg as release from products was not factored in original inventory. Analysis currently underway.

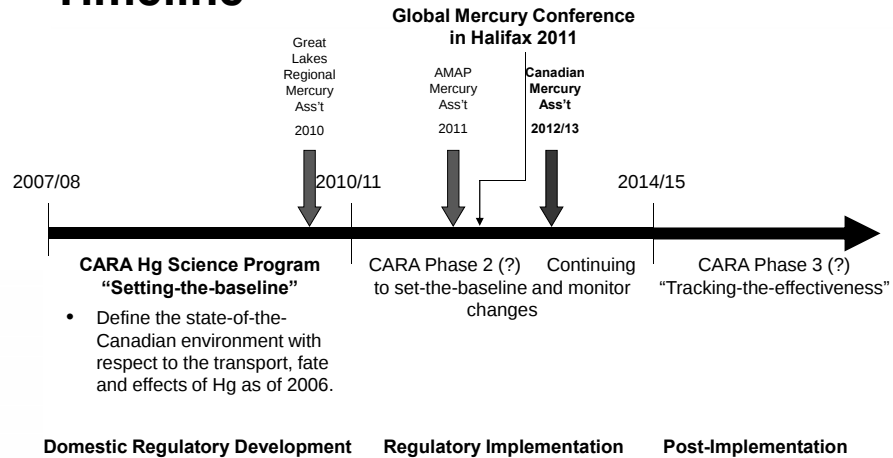
Environment Canada, Pollution Data Branch, 2008

Clean Air Regulatory Agenda

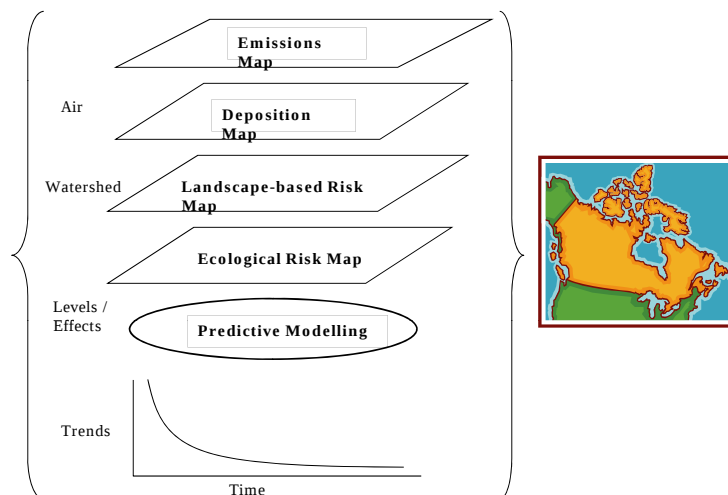


- **Actions** to reduce emissions of SO_x, NO_x, VOCs, GHGs and hazardous air pollutants including Hg.
- Regulation of **industrial sectors** will be most significant activity under the CARA.
- Implementation requires **research, monitoring, modelling and assessment**.

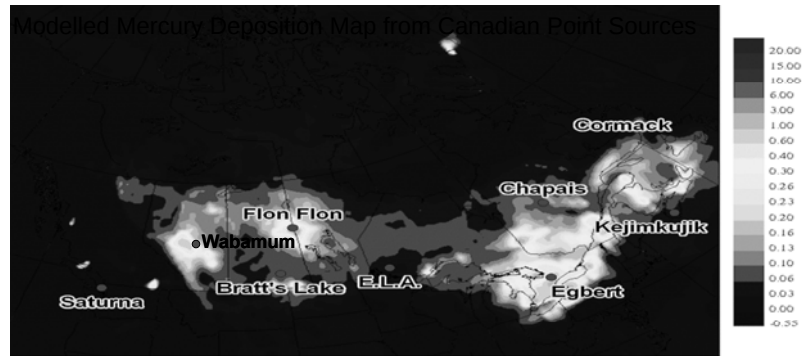
CARA Mercury Science Program: Timeline



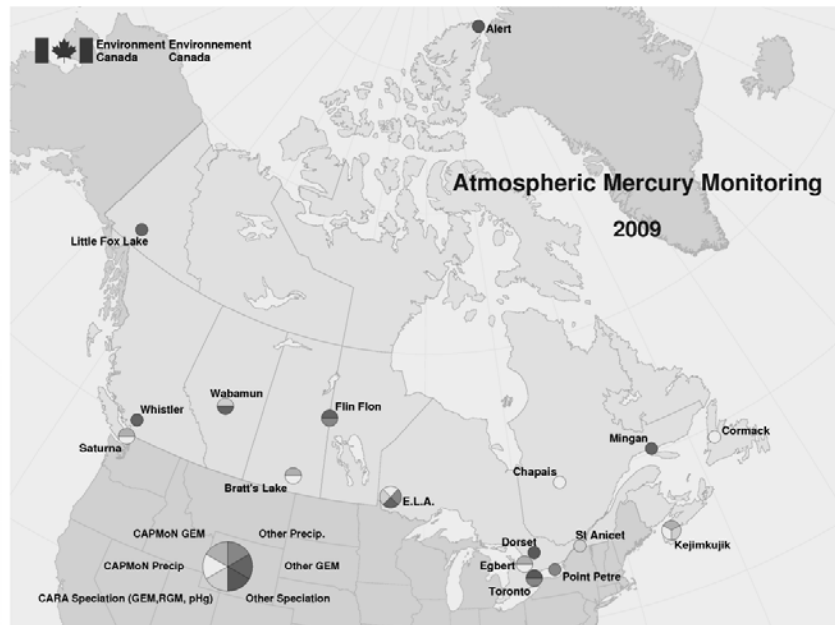
Goal of Phase 1: To enhance and advance on-going and past research and monitoring efforts to develop a cohesive national description of mercury pollution in Canada.



CARA Mercury Monitoring Strategy



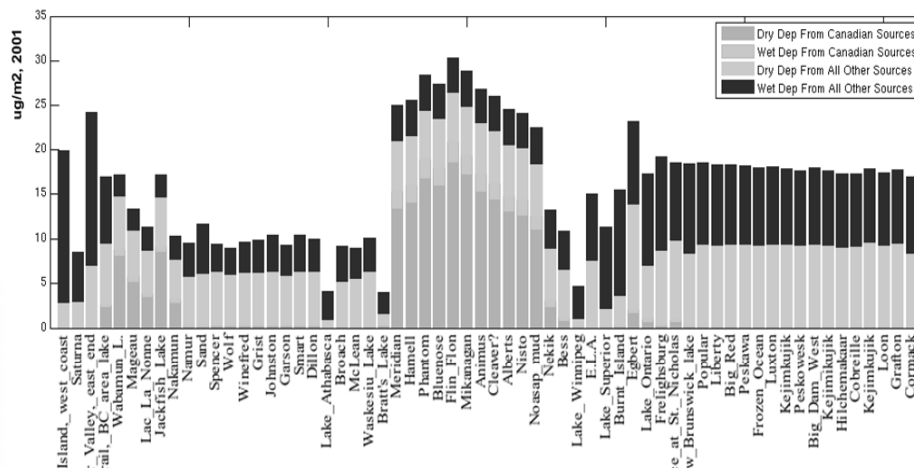
- Combination of low intensity surveys across large regions of Canada and high intensity “supersites”.
- Sites in areas expected to receive high mercury deposition from domestic emitters and where long-standing, multidisciplinary mercury research projects.



Atmospheric Mercury Measurements

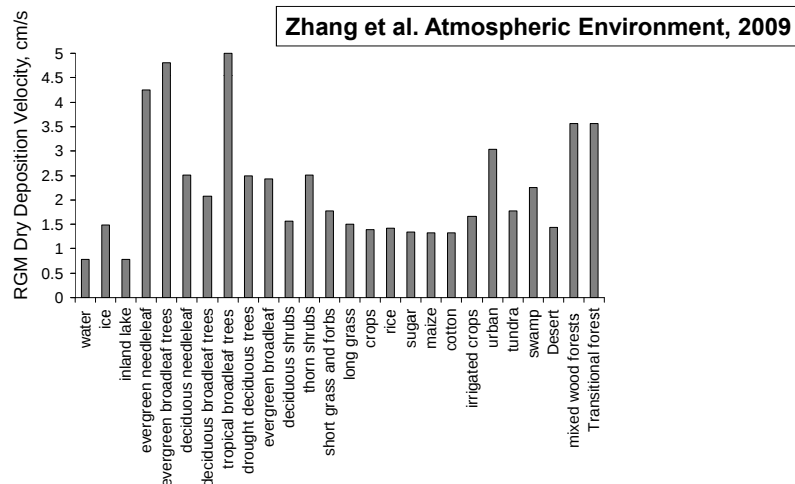
- Total Gaseous Mercury (TGM) or Gaseous Elemental Mercury (GEM):
 - In-situ continuous monitor, 5 min., ~1.5 ng/m³
- Mercury in precipitation:
 - precipitation collector, weekly sample, 5-15 ng/L.
 - US Mercury Deposition Network or sent to Canadian laboratory.
 - Methyl Mercury analyses at some sites.
- Mercury Speciation:
 - In-situ, research-grade system, 2-3 hours.
 - Gaseous Elemental Mercury
 - Particulate Mercury, pg/m³
 - Reactive Gaseous Mercury (RGM) or Gaseous Oxidized Mercury (GOM), pg/m³
 - Research into methodology improvements.

Importance of Mercury Dry Deposition Process

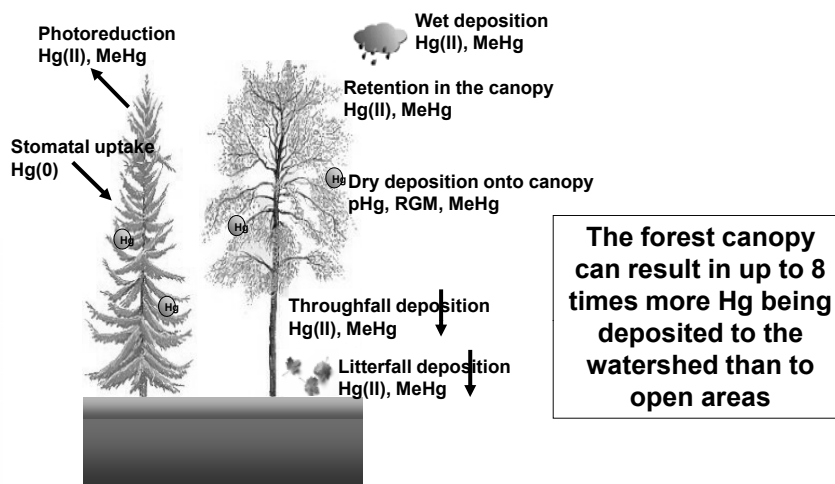


Dastoor et al: Modelled Mercury Deposition Across Canada ($\mu\text{g m}^{-2} \text{ y}^{-1}$).

R&D: Modelling Dry Deposition of Atmospheric Mercury



Whole Ecosystem Total Deposition: Vince St. Louis and Jenny Graydon (U. of Alberta)



R&D: New Methods for Mercury Speciation, Parisa Ariya et al. (McGill University)

Gold Nanoparticle Microextraction of
RGM:

- Gold preconcentrates RGM through adsorption and amalgamation
- Nanoparticles have high surface area, can be placed on portable fibers, filters and other surfaces.
- Microextraction exposes air stream to small quantity of nanoparticles

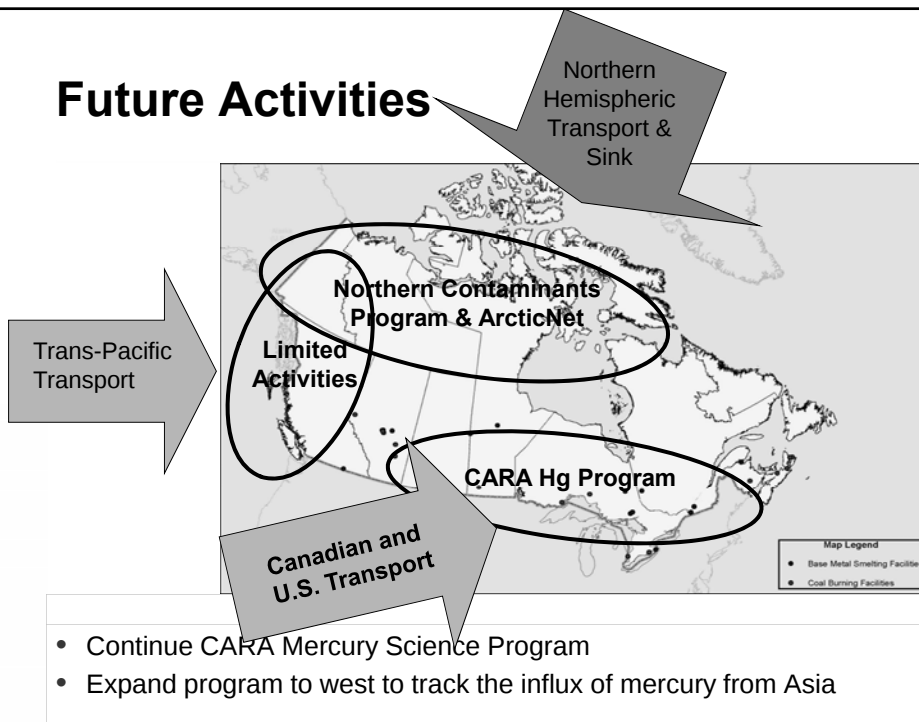
Atmospheric Pressure Chemical
Ionization Tandem Mass Spectrometry
used to detect mercury species.



Collaboration with NADP-MDN-AMNet

- CAPMoN sites part of MDN. Intercomparison sites.
- Canadian scientists participate in the development of SOP and QA/QC protocols used for both Canadian and US NADP-AMNet sites.
- Speciation data QC intercomparison:
 - Compare data quality control handling methods between NADP program and EC's RDMQ module.
 - Year-long data sets from sites have been exchanged with NADP

Future Activities



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