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# CARA Mercury Science Program

**Heather Morrison**

**ASAI**

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# Clean Air Regulatory Agenda

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- **Actions** to reduce emissions of SO<sub>x</sub>, NO<sub>x</sub>, 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**.



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# CARA Mercury Science Program

2007

2011

## Phase 1: Set the Baseline

- Define the state-of-the-Canadian environment with respect to the transport, fate and effects of Hg as of 2006.
- Deliverable: Assessment due 2012
- Science Plan: To identify research and monitoring projects that will enable EC to present a cohesive national description of mercury pollution across Canada.

2011

2015

## Phase 2: Describe the Benefits

- Describe the benefits of the regulations.
- Deliverable: Assessment due 2017
- Science Plan: Track the efficacy of the regulations



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Reductions in mercury emissions from the CARA will come from coal-fired power plants and base-metal smelters.



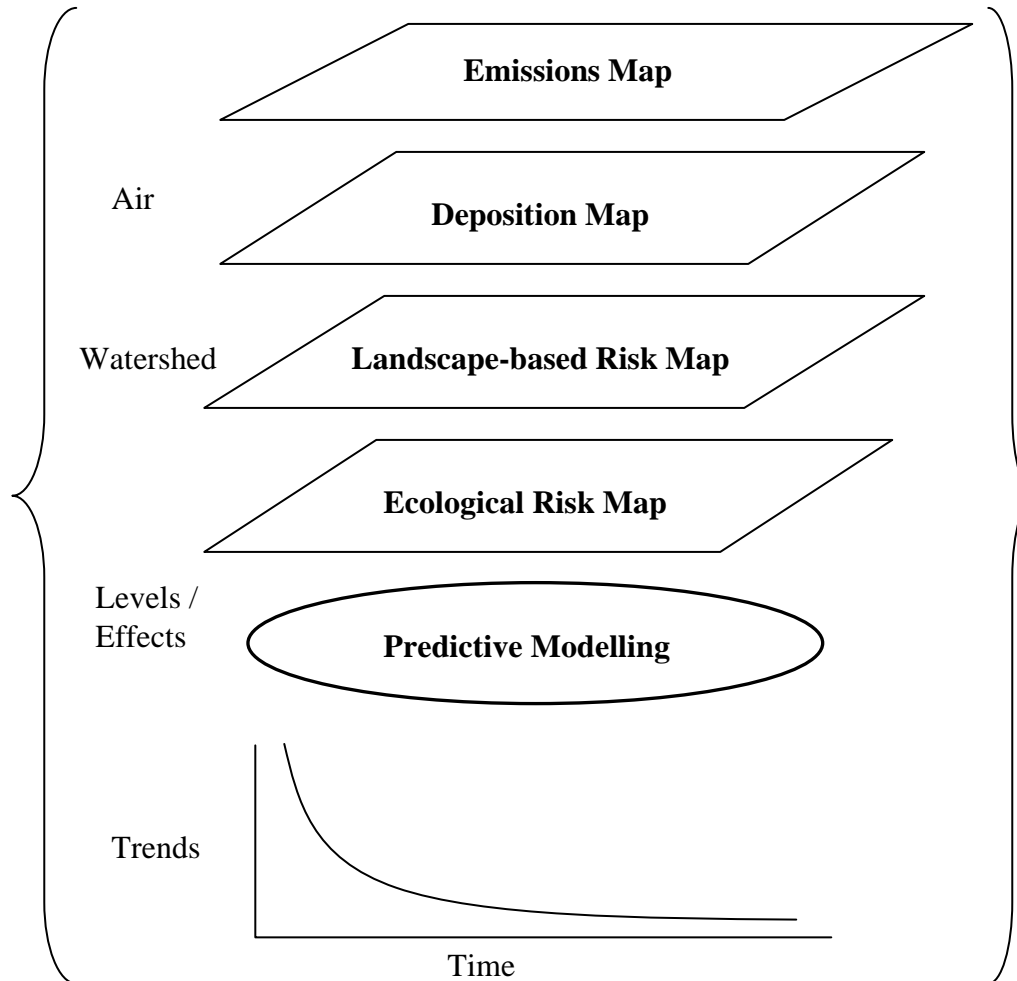
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2007 Criteria Air Contaminant (CAC) Section  
Pollution Data Division  
2006 NPRI Emission Inventory  
November 2007



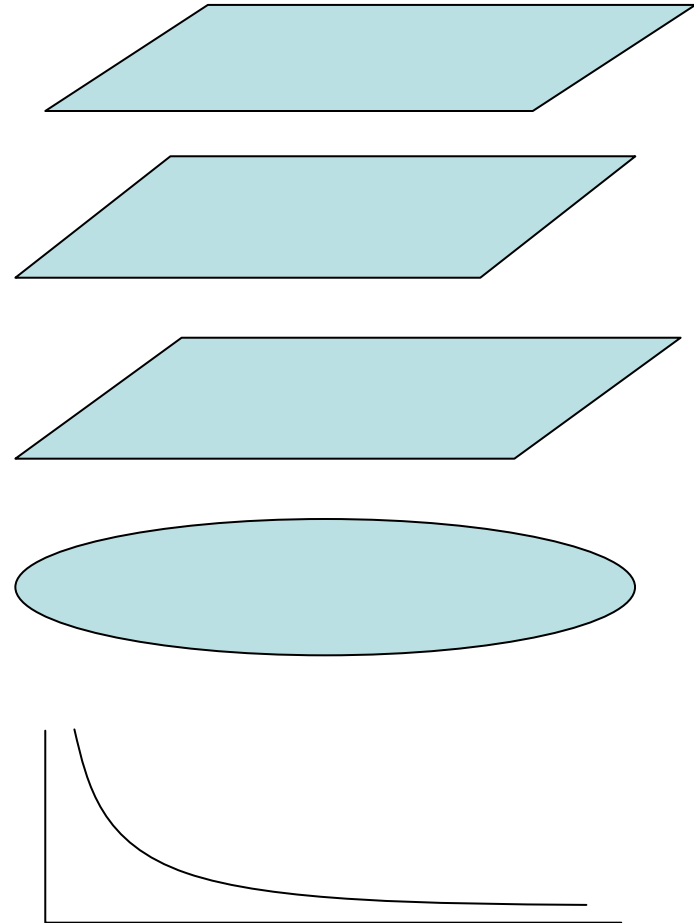
# Goal of Phase 1: To enhance and advance on-going and past research and monitoring efforts to develop a cohesive national description of mercury pollution in Canada.



# Science Plan:

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- Atmospheric Monitoring
- Landscape-based Risk Assessment and Mapping
- Ecological Risk Assessment and Mapping
- Ecosystem Modelling
- Trends



# Monitoring Program

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- CARA “Supersites” characterized by intensive ecosystem monitoring
  - central Alberta (cluster of coal-fired power plants)
  - central Manitoba (Flin Flon smelter)
  - north western Ontario (Experimental Lakes Area)
  - central Ontario (Dorset)
  - northern Quebec?
  - southern Nova Scotia (Kejimikujik Park)
- Less intensive monitoring of ecosystem components across broad regions of Canada



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# Atmospheric Monitoring

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## Objectives:

- Describe the changing concentrations of mercury in the air and precipitation across Canada.
- Increase our understanding of the contribution of dry deposition to total deposition of atmospheric mercury at the CARA Hg “supersites”
- Measure atmospheric mercury concentrations downwind of CARA-impacted sites.



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# Atmospheric Monitoring

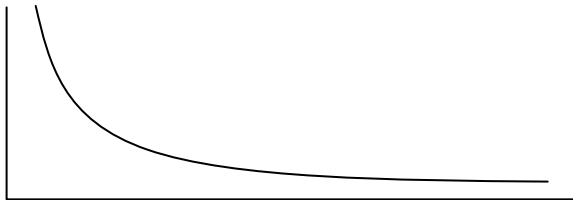
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## Key Outcomes:

- Development and verification of a Hg deposition map



- Trends in ambient concentrations of mercury



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# Key Activities 2008/09

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- Expanding mercury monitoring at CAPMon sites
- Monitoring of GEM, TPM and RGM at CARA Hg “supersites”
- Implement speciation monitoring in Alberta
- QA/QC activities



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# Landscape-based Risk Assessment and Mapping

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## Objectives and Key Outcomes:

- Development and verification of a risk map for exposure to mercury based on the nature of the abiotic components of ecosystems (ex. underlying geology).



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# Key Activities 2008/09

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- Compilation of key geochemical, water and sediment databases for mercury.
- Field collections of water and sediment within the auspices of the tri-national soil study.
- Preliminary mapping of water and sediment Hg concentrations.



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# Ecological Risk Assessment and Mapping

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## Objective:

- To conduct a spatial risk assessment of current mercury levels for predatory fish and wildlife across Canada.



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# Ecological Risk Assessment and Mapping

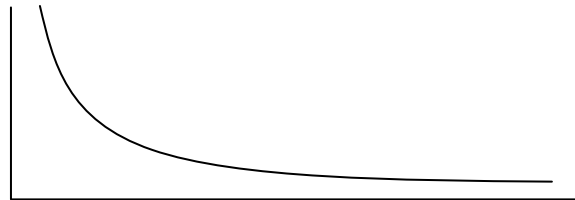
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## Key Outcomes:

- Development and verification of a map of levels of mercury in fish and wildlife across Canada and the risk to biota and humans associated with those levels.



- Trends in levels of mercury in fish and wildlife



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# Key Activities 2008/09

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- Compile existing fish mercury data into a national database
- Identify data gaps
- Build on existing efforts to develop a national monitoring program for mercury levels in fish and wildlife



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# Ecosystem Modelling

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## Objectives:

- To develop the capacity to predict the effects of changes in atmospheric emissions of mercury on levels of mercury in fish.
- To help distinguish these effects from two other anthropogenic influences on Hg cycling and bioaccumulation: climate change and sulphur deposition.
- To help identify regional sensitivity and the extent to which the mercury benefits of CARA may vary on a broad national scale.



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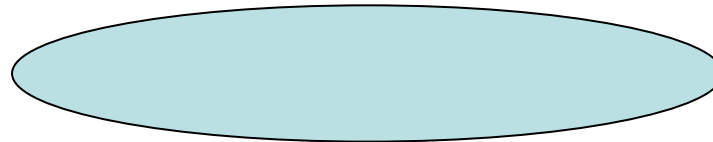


# Ecosystem Modelling

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## Key Outcome:

- Modelling framework capable of predicting the concentration of mercury in fish based on levels of atmospheric emissions of mercury.



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# Key Activities 2008/09

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- Development of atmospheric model and linkages between this model and the landscape and fish models
- Laboratory studies to define some of the reactions governing the atmospheric transport and fate of mercury.
- Analyses of field data to better define reactions of mercury in terrestrial and aquatic ecosystems.



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# Trends

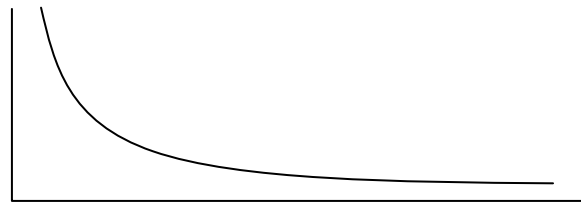
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## Objectives:

- To ground-truth deposition modelling and terrain sensitivity mapping and to develop stronger temporal trend records in regions downwind of past and present sources of mercury emissions.

## Key Outcomes:

- Temporal and spatial trends in mercury deposition downwind of important source-regions for mercury and sulphate using sediment cores and food webs.



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# Key Activities 2008/09

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- Field collections at CARA Hg “supersites”
- Laboratory analysis
- Preliminary data analysis

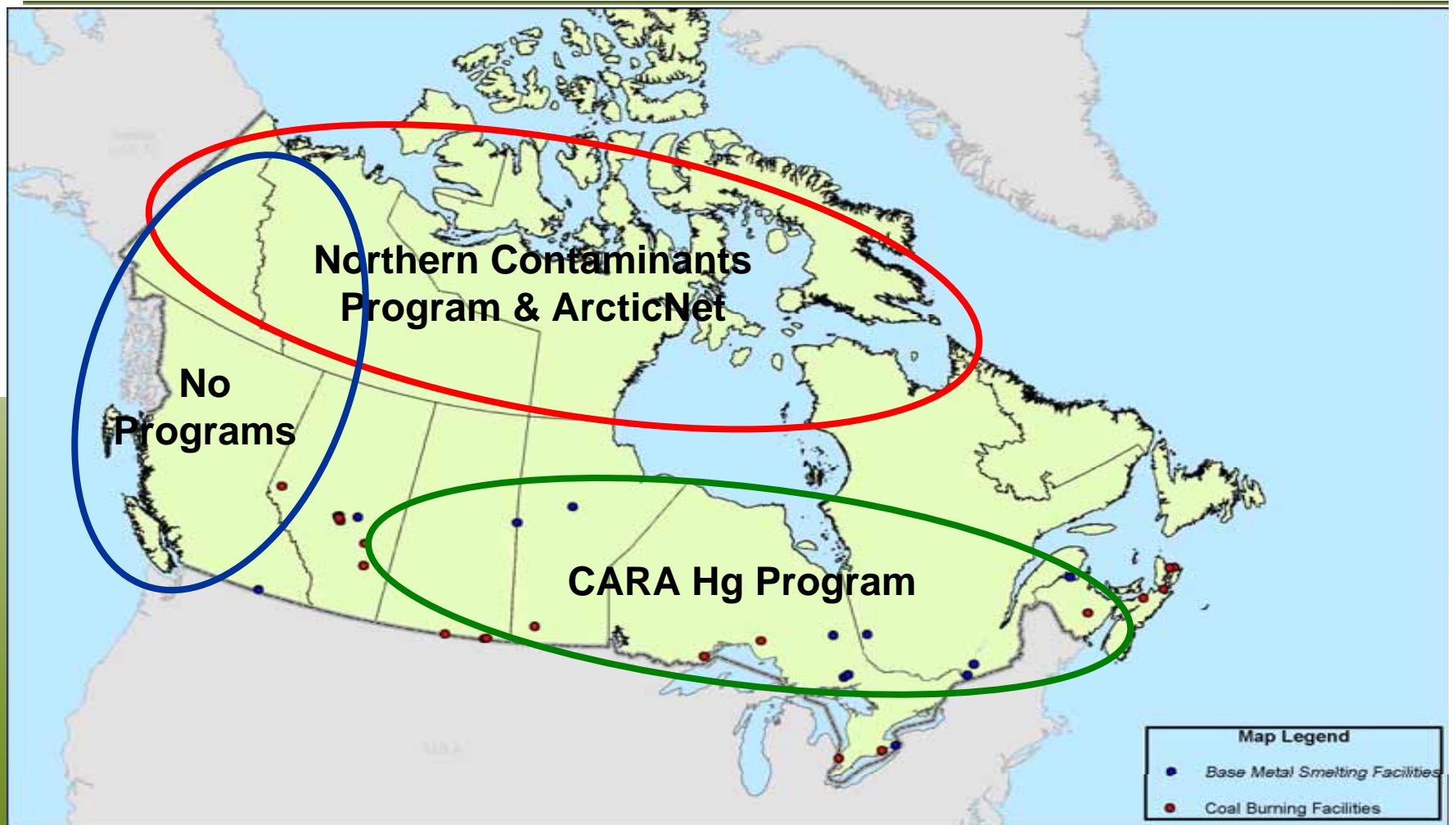


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# Spatial focus of CARA research and monitoring



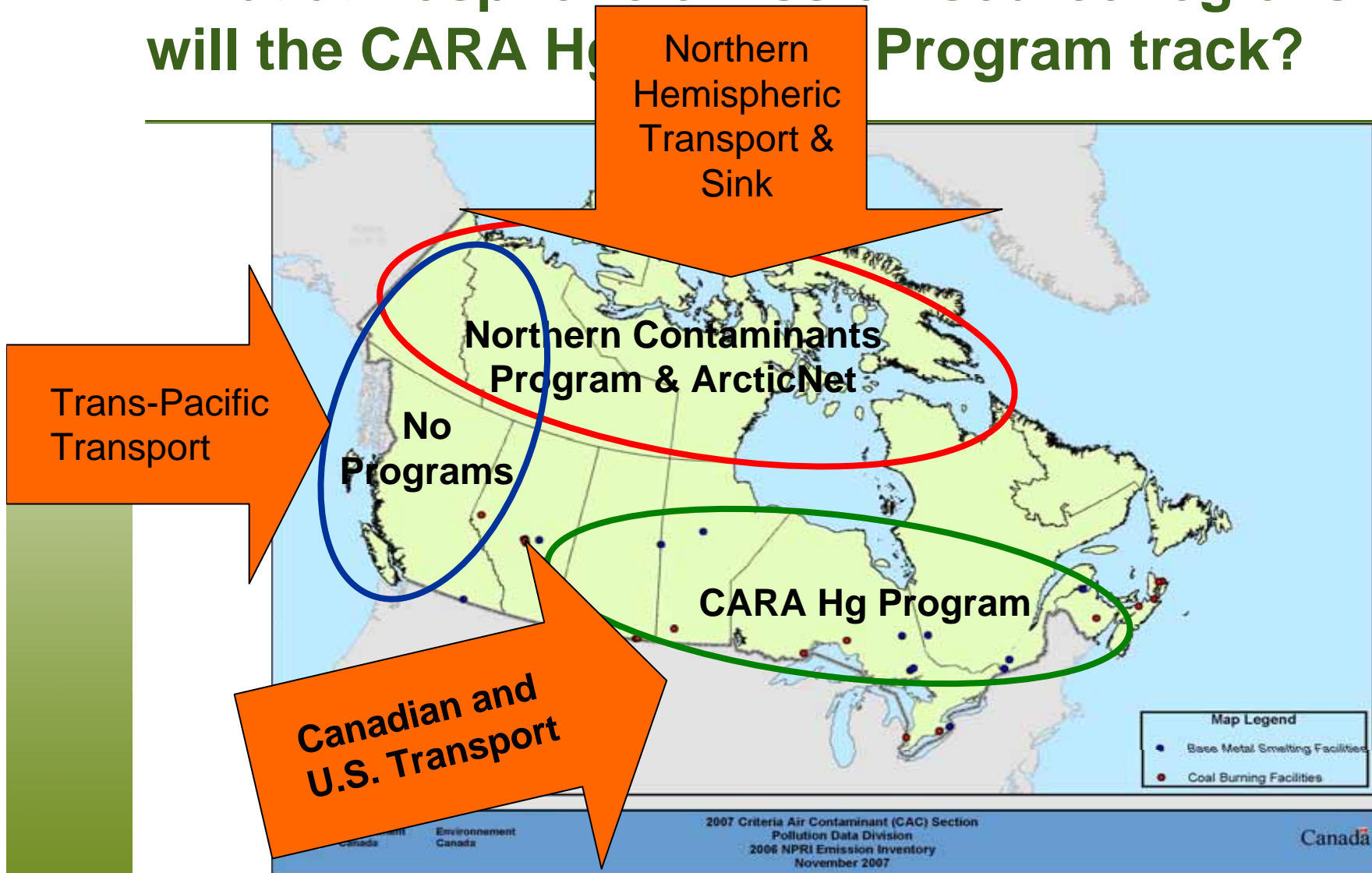
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# What atmospheric emission source regions will the CARA Hg Program track?



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UNEP Global Hg Program

UNECE Heavy Metals Protocol

Arctic Council Action Plan Hg Project

North American Regional Action Plan

Great Lakes Canada-U.S.  
Bi-national Toxics Strategy

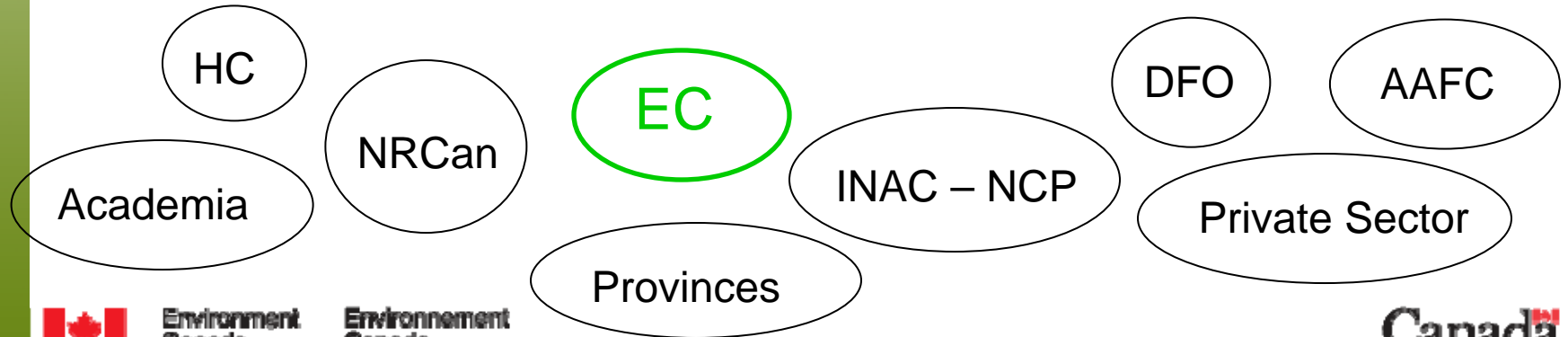
New England Governors/Eastern  
Canadian Premiers' Hg Action Plan

CARA

CEPA

CWS

# National Hg Science Blueprint



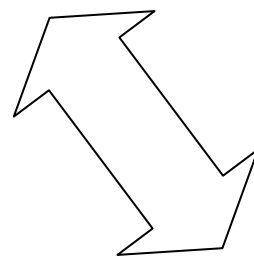
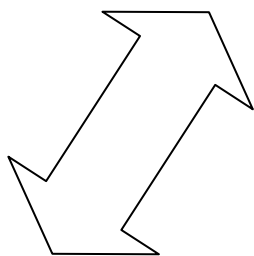
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# National Hg Science Blueprint

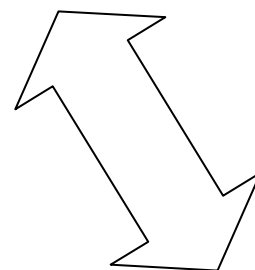
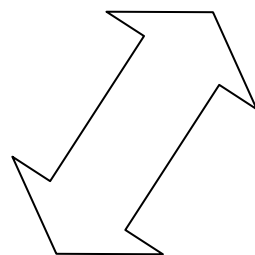
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OGDs, Provinces, Academia Hg  
Science Program

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Environment Canada  
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Other EC Hg Science  
Activities

+

CARA Hg Science Plan



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# Delivery of Science Plan

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- This EC led program is being delivered by our department in conjunction with NRCan, DFO, academia and, through co-sponsorship of projects, the provinces, industry and other federal government departments.



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