



Health Canada's Biomonitoring Approach

Environmental Health Surveillance Workshop

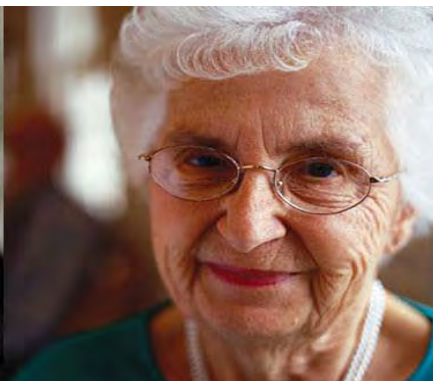
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Presentation Objectives

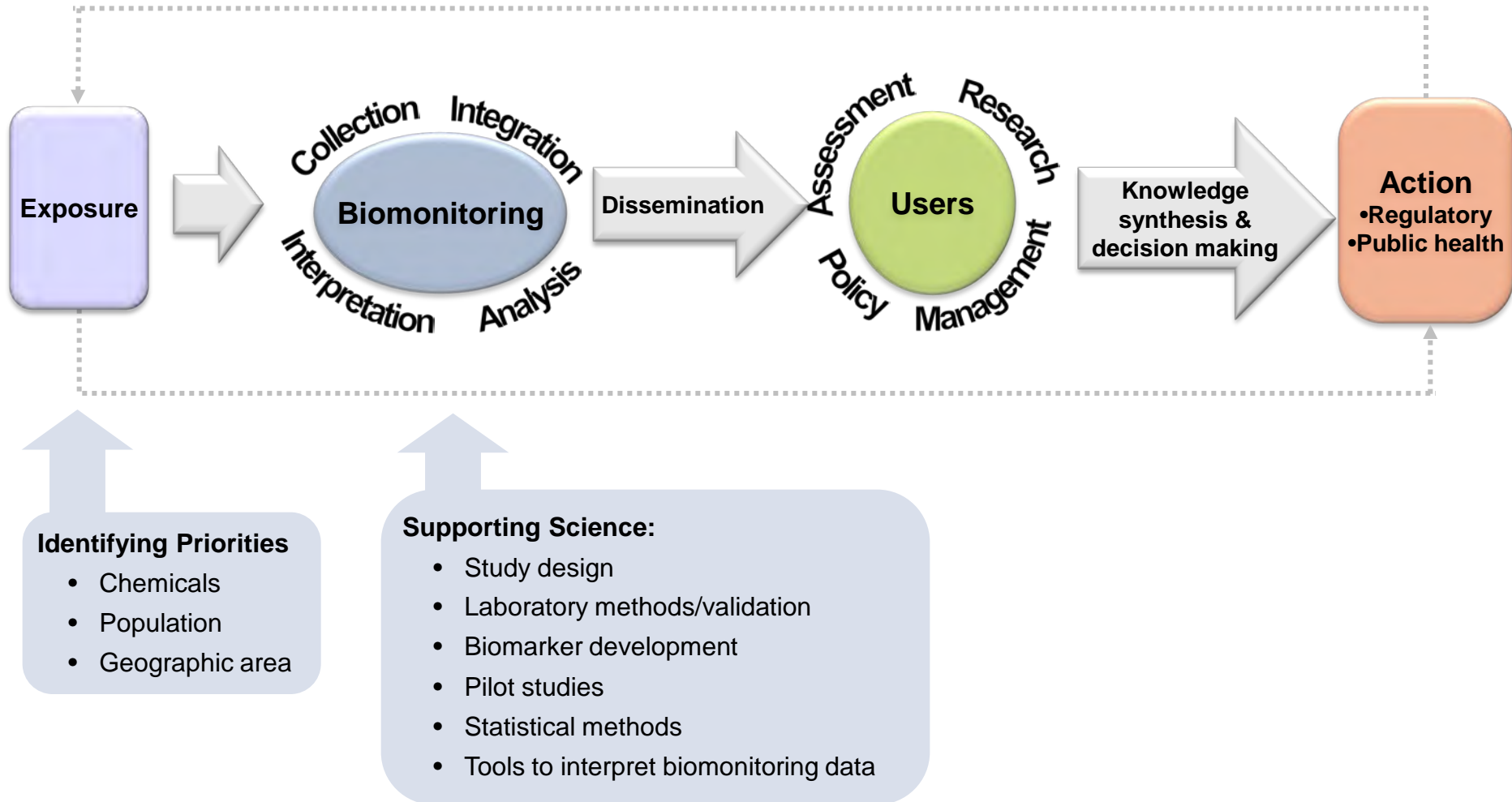
- To provide an overview of Health Canada's biomonitoring approach
- Main focus on the biomonitoring component of the Canadian Health Measures Survey
- Framework and infrastructure for biomonitoring

Chemicals Management Plan

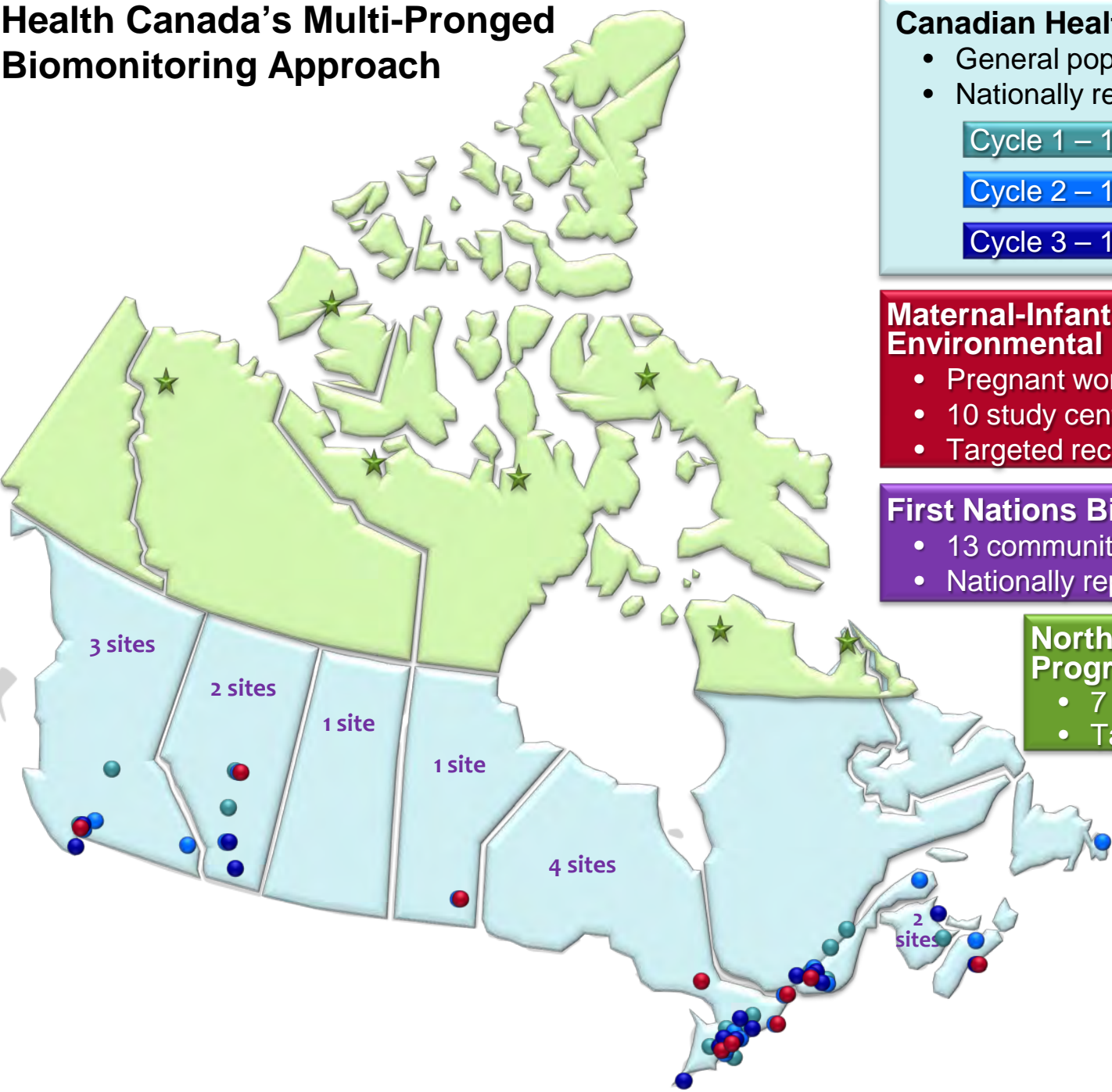
In 2006, the Government of Canada launched the Chemicals Management Plan (CMP) to advance and improve the management of chemical substances and safeguard the health of Canadians.



Human Biomonitoring Context



Health Canada's Multi-Pronged Biomonitoring Approach



Canadian Health Measures Survey

- General population (n=5,000-6,000)
- Nationally representative

Cycle 1 – 15 sites (2007-2009)

Cycle 2 – 18 sites (2009-2011)

Cycle 3 – 16 sites (2012-2013)

Maternal-Infant Research on Environmental Chemicals

- Pregnant women-infant cohort (n=2,000)
- 10 study centres
- Targeted recruitment

First Nations Biomonitoring Initiative

- 13 communities (n=500)
- Nationally representative (on reserve)

Northern Contaminants Program

- 7 regions, since 1991
- Targeted studies and surveys

Canadian Health Measures Survey (CHMS)

- National health survey that collects data on the general health and lifestyles of Canadians to provide information on chronic and infectious disease, physical fitness, nutrition, and other factors that influence health
- Human biomonitoring component



Partners

Statistics Canada

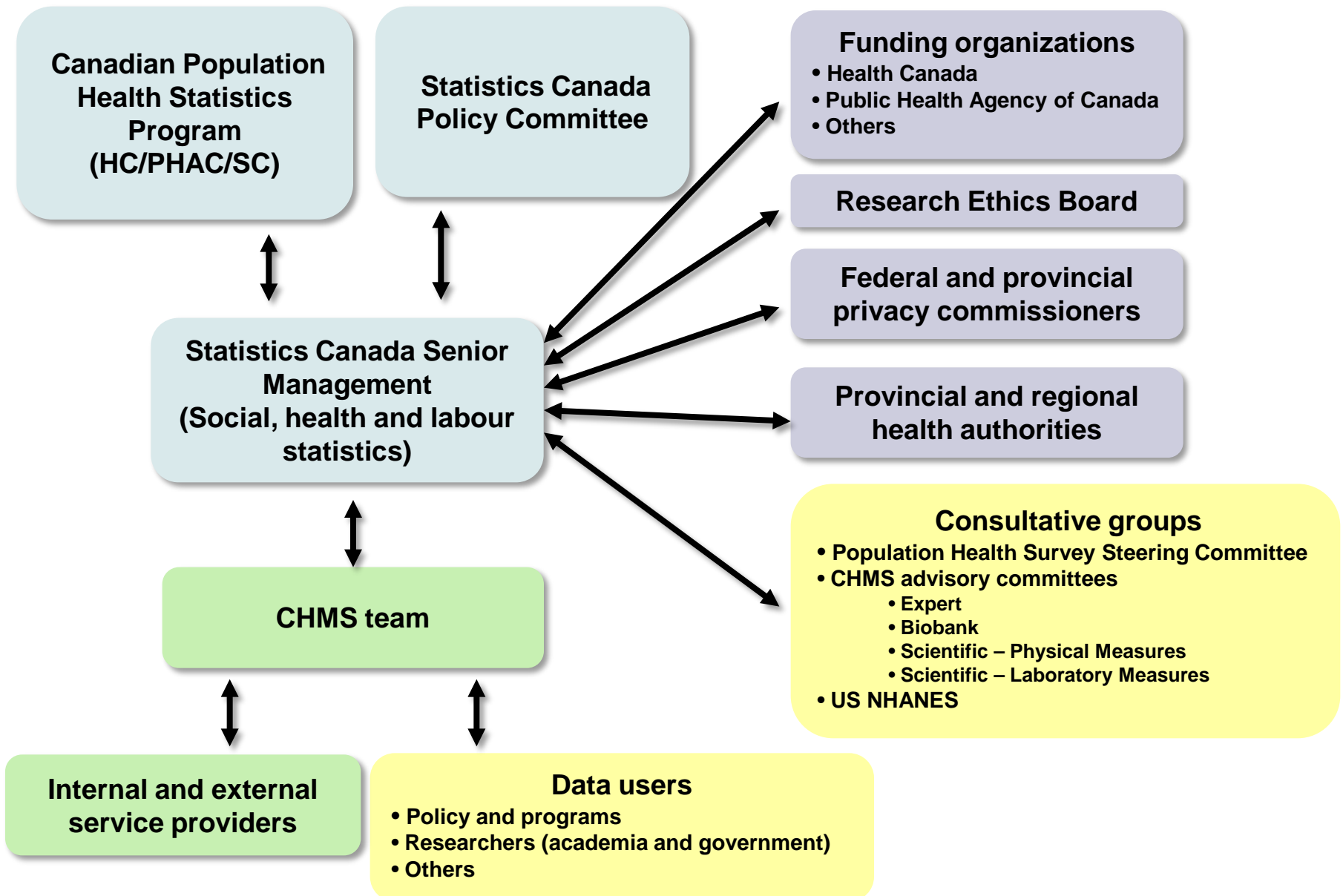
Health Canada

Public Health Agency of Canada

CHMS Biomonitoring Component Objectives

- Establish nationally-representative blood and urine concentrations for environmental chemicals
- Provide baseline data to track temporal trends and to allow for comparisons with sub-populations in Canada and with other countries
- Provide data to explore relationships between environmental chemicals, other physical measures, and self-reported information

CHMS governance structure



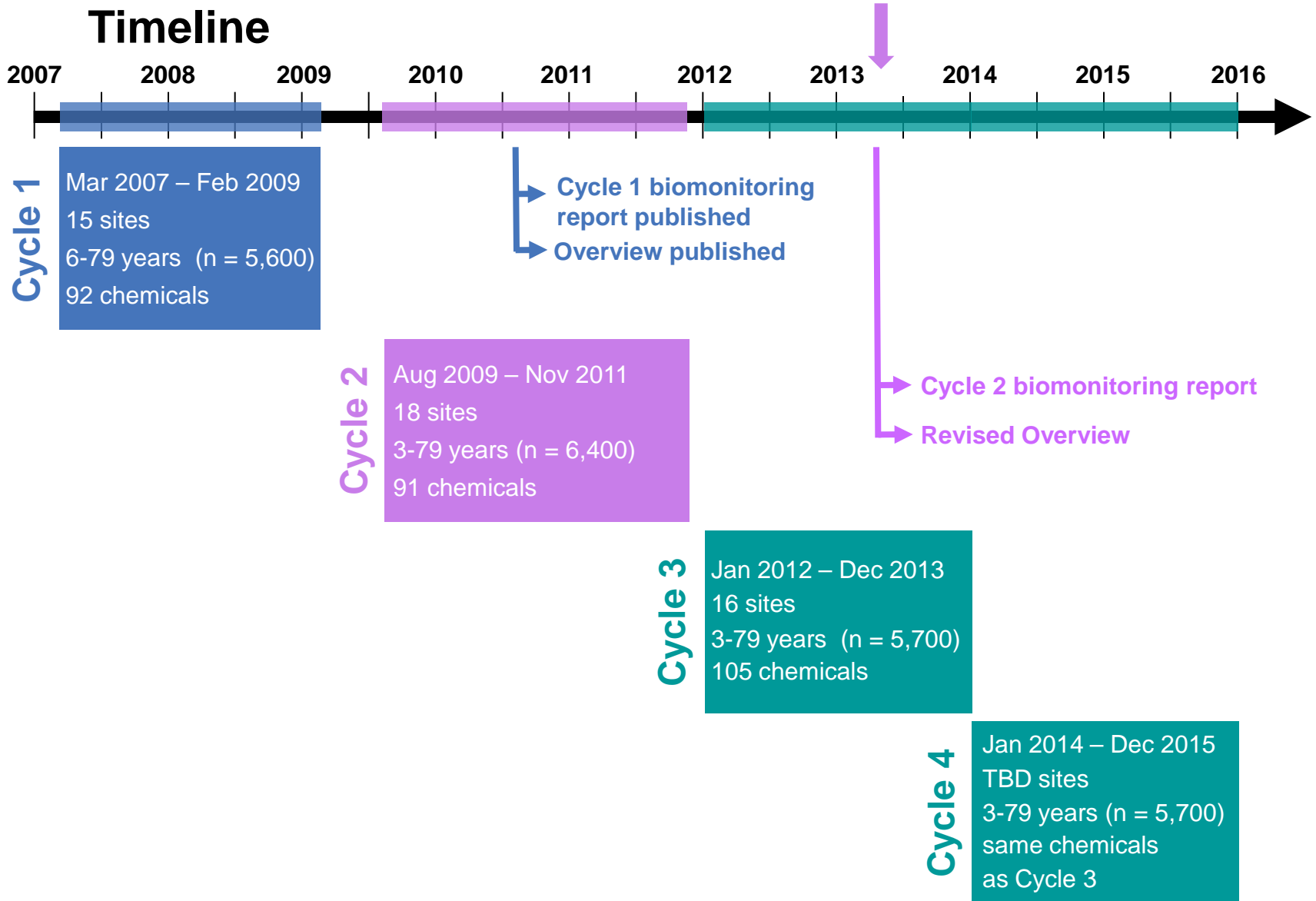
CHMS Survey Design

- Cross-sectional survey carried out in 2 year cycles
- Nationally-representative sample covering 96% of population
- Sample size: 5,500 – 6,000
- Age groups (yrs): 3-5, 6-11, 12-19, 20-39, 40-59, 60-79

- Home interview - health questionnaire
- Mobile Examination Centre - direct measures
- Household - indoor air (start in cycle 2) tap water (start in cycle 3)

- Informed consent for all components

CHMS Cycles – Biomonitoring

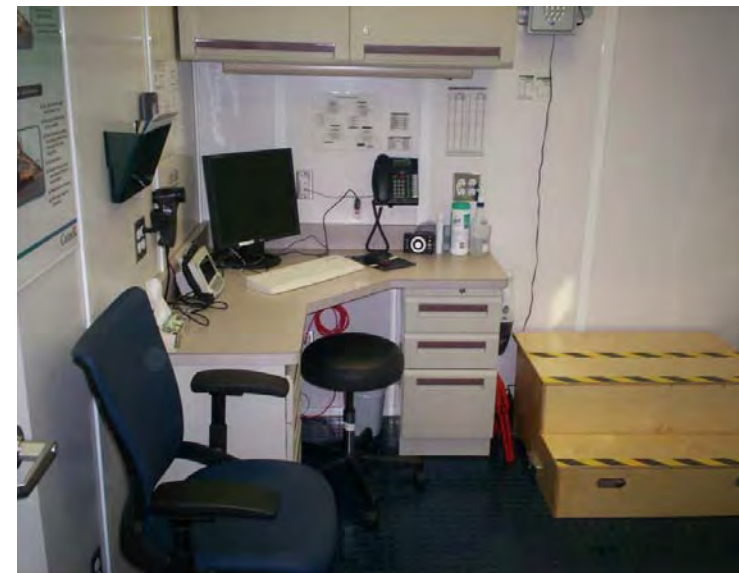


Direct Measures (Mobile Examination Centre, MEC)

- Field staff: accredited and qualified health specialists and technicians
- 12 dedicated Statistics Canada interview staff
- Medical advisor working from central office

Measures

- Anthropometry
- Cardiorespiratory and musculoskeletal fitness
- Physical activity
- Oral health exam (cycle 1)
- Blood measures
 - Environmental chemicals, nutritional status, diabetes, cardiovascular disease, infectious disease, blood chemistry, DNA and biobank samples (stored)
- Urine measures
 - Environmental chemicals, iodine, microalbumin, creatinine
- Audiometry (cycle 3)
- FENO (fractional exhaled nitric oxide) (cycle 3)



Selection of Environmental Chemicals for CHMS

Based on:

- Health Canada program priorities
- Expert workshop (2003) and national stakeholder consultations (2008)

Criteria

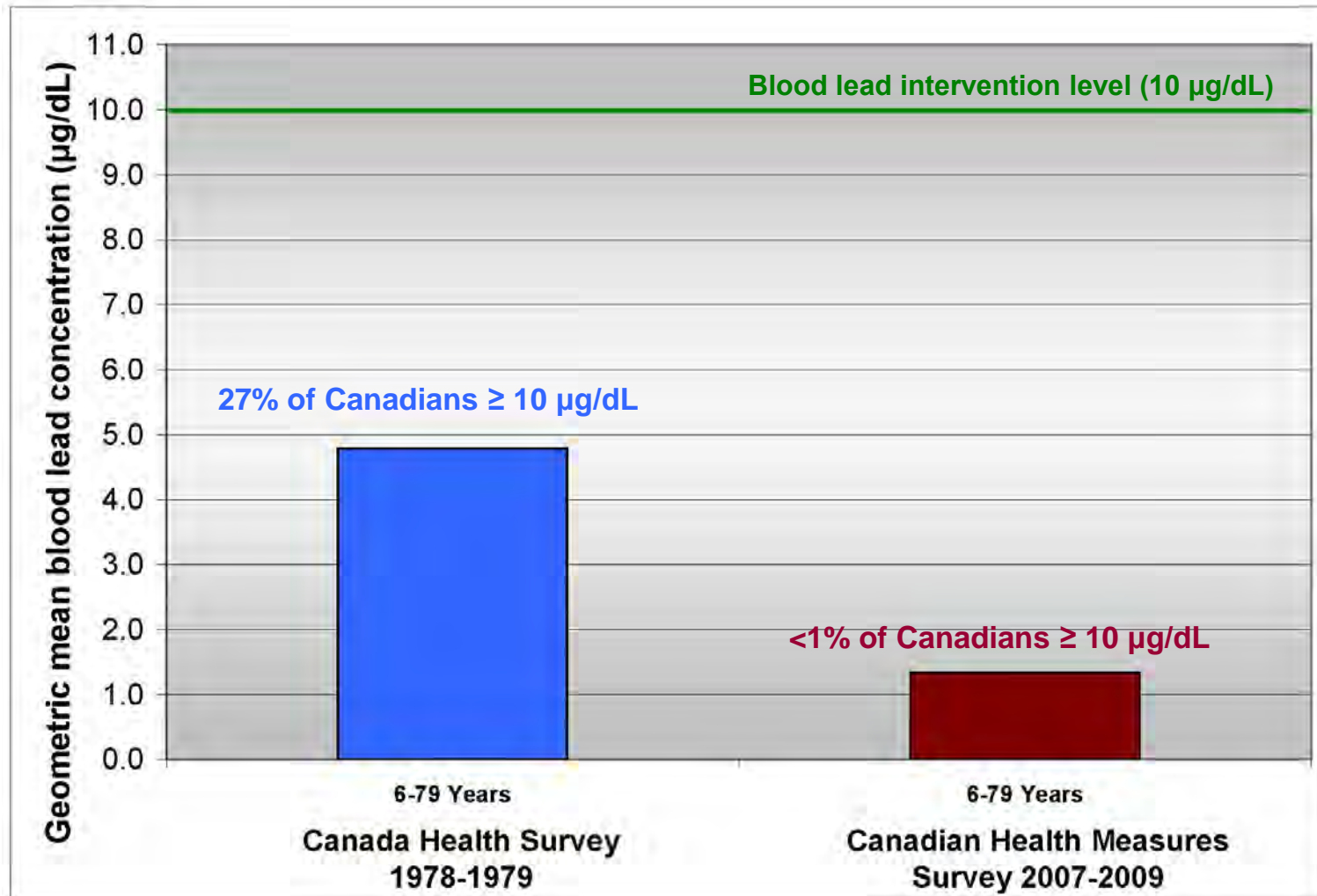
- Public health considerations (known or suspected health risk or effects, need for public health action, public concern)
- Regulatory needs (risk assessment and management)
- Evidence of population exposures or sources of exposure
- Feasibility of field collection of biospecimens / respondent burden
- Availability and efficiency of laboratory analytical methods
- Consistency with other surveys
- International commitments (e.g., Stockholm Convention on POPs)
- Cost

CHMS Biomonitoring Chemicals

	Cycle 1	Cycle 2 (55% new)	Cycle 3 (40% new)
Metals & Trace Elements	●	●	●
PCBs	●		●
Organochlorines & POPs	●		●
Dioxins/Furans	●		●
Flame retardants	●		●
Perfluorinated Compounds	●	●	
Phthalates	●	●	
Environmental Phenols	●	●	●
Current Use Pesticides	●	●	●
PAHs		●	●
Benzene Metabolites		●	●
Parabens			●
VOCs			●
Acrylamide			●
Smoking Status	●	●	●

Regulatory Case: Effectiveness of Control Actions

Decreasing Blood Lead Concentrations

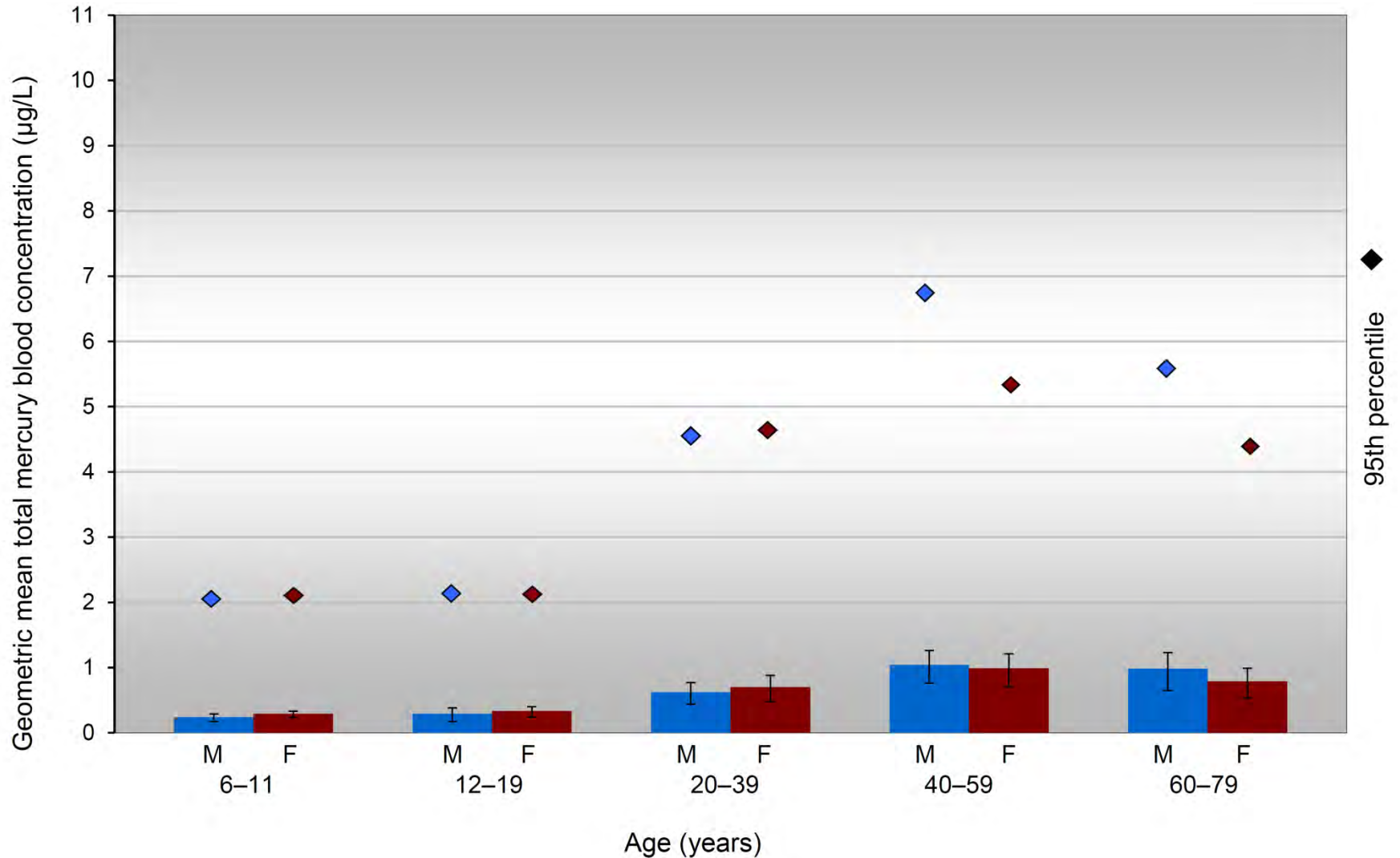


98% of measures < 5 µg/dL

75% of measures < 2 µg/dL

Public Health Case: Assessing Exposure/Risk

Blood Total Mercury Levels in Canadians (CHMS 2007-2009)



Public Health Case: Assessing Exposure/Risk

- Blood guidance level for general adult population (M > 18 yrs, F > 49 yrs) is **20 µg/L**
- Proposed blood guidance level for children and women of childbearing age (M ≤ 18 yrs, F ≤ 49 yrs) is **8 µg/L**

Estimated population (N) and percentage with blood mercury levels below their respective guidance values for selected Canadian population groups

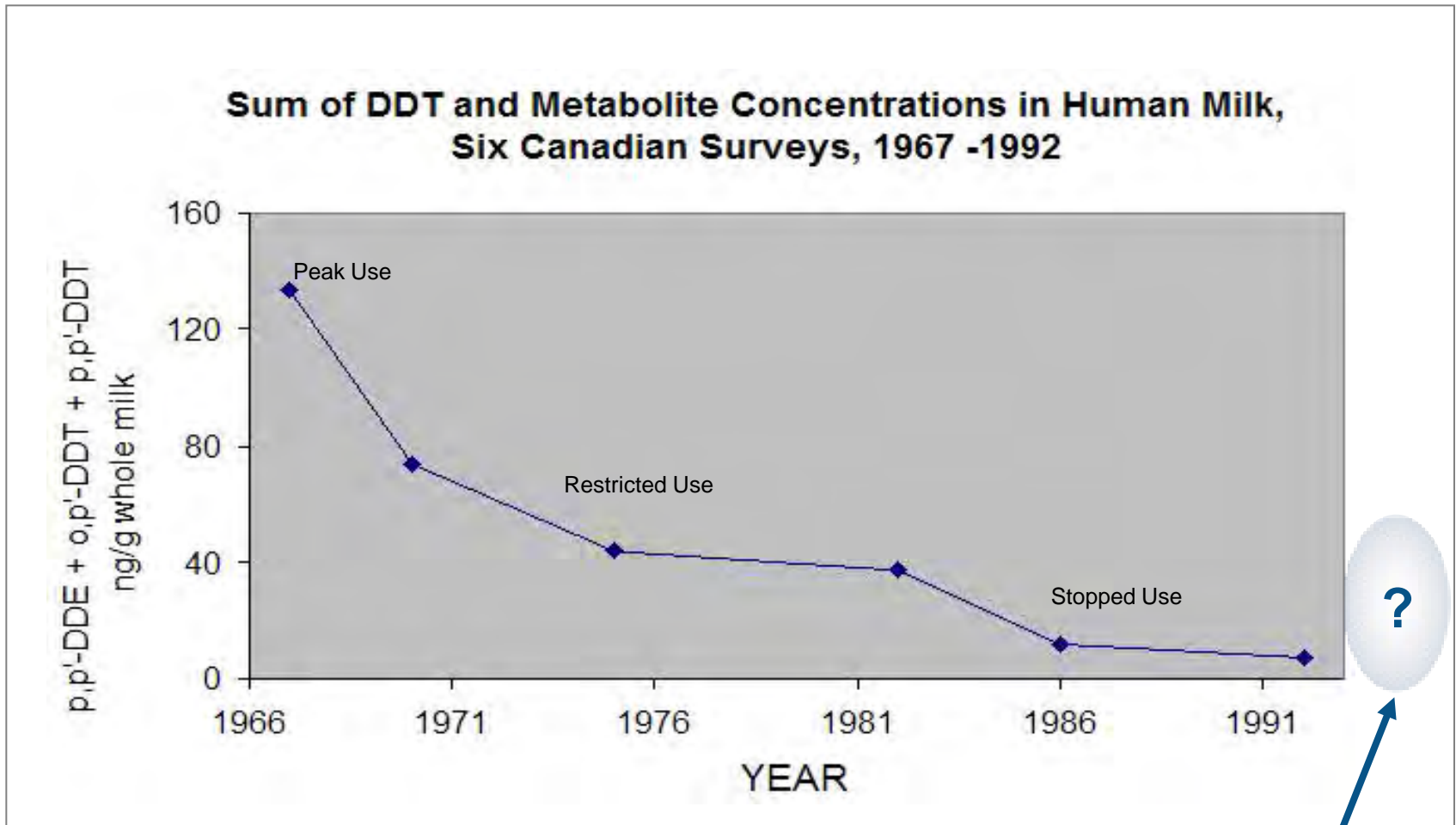
Population Group	N	% < 8µg/L (95% CI)	% < 20µg/L (95% CI)
Females 16-49 yrs (incl. pregnant women)	7,669,012	97.78 (92.11 – 99.40)	*
Females 6-49 yrs, pregnant women, males ≤18 yrs	11,541,258	98.39 (93.59 – 99.61)	*
Females > 49 yrs, males >18 yrs	†	*	†

* Guidance value not applicable to selected population

† The estimated N and percentage of females ≥50 yrs and males >18 yrs with blood mercury levels <20 µg/L were not calculated in order to meet the confidentiality requirements of the *Statistics Act* of Canada

Regulatory Case: Effectiveness of Control Actions

Decreasing DDT Concentrations in Human Milk



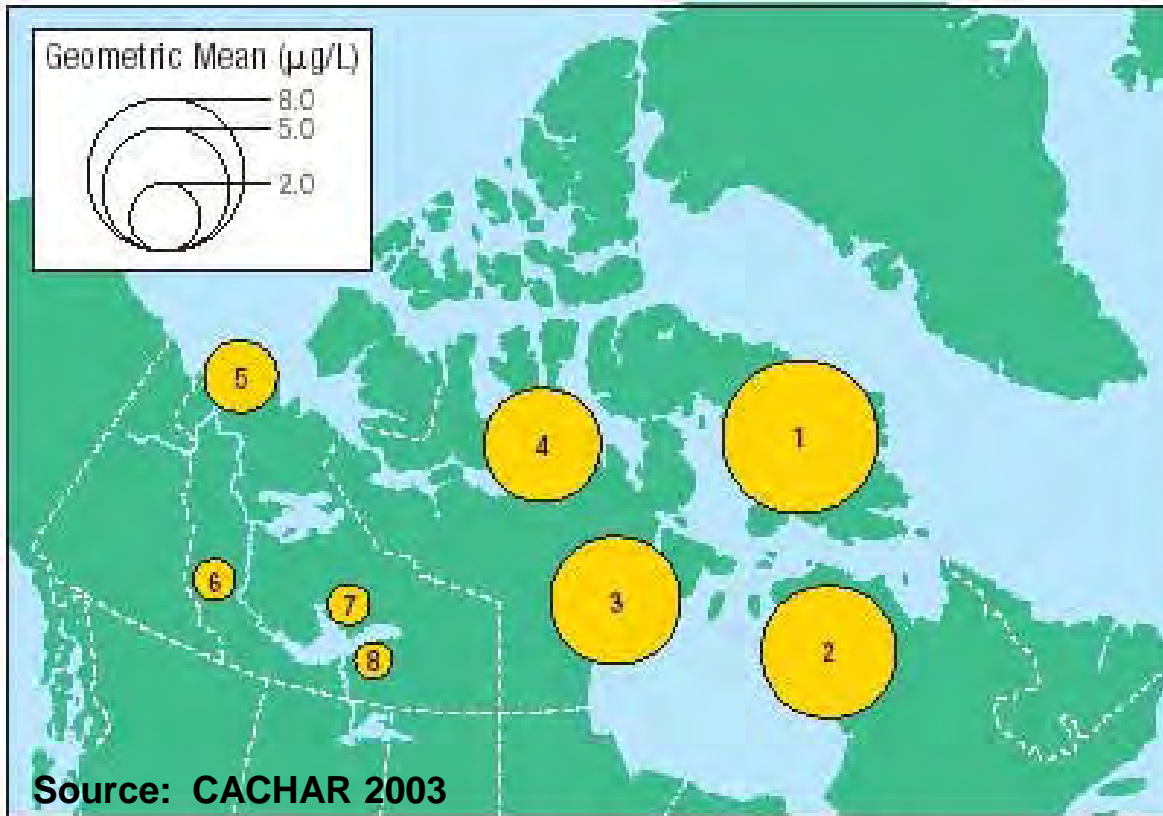
Source: Craan and Haines, 1998

MIREC 2009-2011

Public Health Case: Identifying Exposed Populations

Maternal Contaminant Levels in Arctic Canada

PCBs (as Aroclor 1260) ($\mu\text{g/L}$ plasma)



- 1: 8.0 $\mu\text{g/L}$ Inuit - Baffin
- 2: 6.0 $\mu\text{g/L}$ Inuit - Nunavik
- 3: 5.6 $\mu\text{g/L}$ Inuit - Kivalliq
- 4: 4.5 $\mu\text{g/L}$ Inuit - Kitikmeot
- 5: 2.4 $\mu\text{g/L}$ Inuit - Inuvik
- 6: 1.3 $\mu\text{g/L}$ Dene/Métis
- 7: 1.3 $\mu\text{g/L}$ Caucasian
- 8: 1.1 $\mu\text{g/L}$ Other

POPs and metal concentrations are 2 to 10 times higher in Inuit who eat traditional foods than in other northern or southern Canadian populations

Selected Uses of Biomonitoring Data

Lead	Human Health State of the Science Report on Lead	Regulatory and public health
Mercury	Canadian Mercury Science Assessment – Health Chapter	National reporting
	Dietary health advice in Arctic communities	Public health
Cadmium, lead, mercury, PBDE	Canadian Environmental Sustainability Indicators	National reporting
Perfluorinated substances	Screening Assessment of Perfluorooctanoic Acid, its Salts, and its Precursors	Regulatory
PBDE	Human Health Risk Assessment for deca-BDE (PBDE 209)	Regulatory
POPs and metals	Informs and tracks Canada's progress on international agreements (e.g., Stockholm Convention on POPs)	International commitments

- CHMS dataset accessible by researchers via Statistics Canada's Research Data Centres

For Additional Information

Human Biomonitoring of Environmental Chemicals

www.healthcanada.gc.ca/biomonitoring

The Canadian Health Measures Survey

www.hc-sc.gc.ca/ewh-semt/contaminants/human-humaine/chms-ecms-eng.php

www.statcan.gc.ca/daily-quotidien/100816/dq100816a-eng.htm

Report on Human Biomonitoring of Environmental Chemicals in Canada

www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/chms-ecms/index-eng.php

Maternal-Infant Research on Environmental Chemicals

www.hc-sc.gc.ca/ewh-semt/contaminants/mirec/

Northern Contaminants Program

www.ainc-inac.gc.ca/nth/ct/ncp