



Health  
Canada

Santé  
Canada

Healthy  
Environments and  
Consumer Safety  
Branch

*Federal Contaminated Sites  
Accelerated Action Plan –  
Health Canada's Roles, Activities  
and Plans*

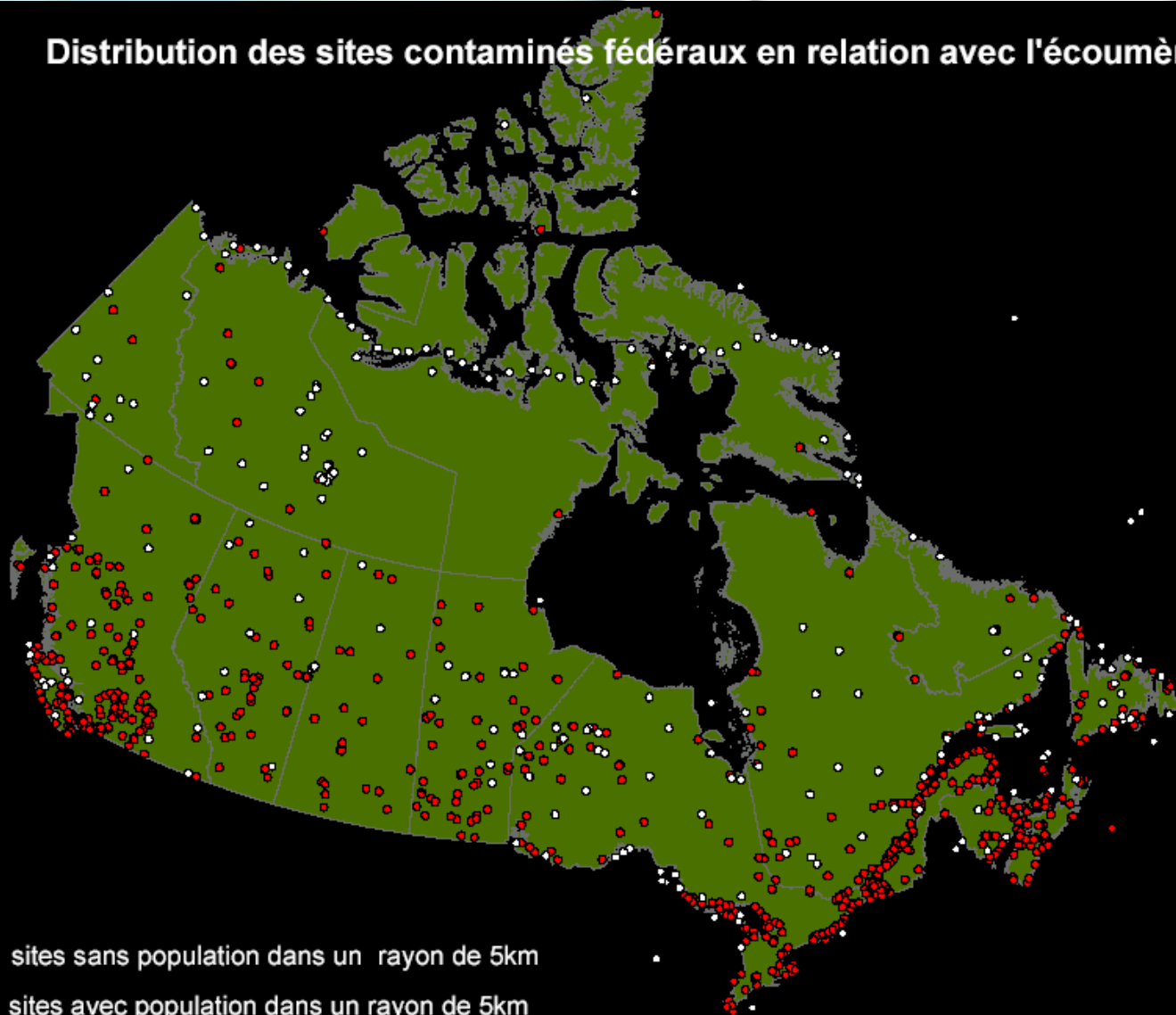
Canada

*Health Canada's Contaminated Sites Program is now on the Web*

- <http://www.hc-sc.gc.ca/hecs-sesc/ehas/index.htm>

# Federal Contaminated Sites in Canada: Where are they and do people live nearby?

Distribution des sites contaminés fédéraux en relation avec l'écoumène



# Health Canada's roles, as an 'Expert Support Department':

- o Human health risk assessment
  - o Guidance
  - o Training
  - o Advice
- o Environmental impact assessment (EIA) of remedial activities under the *Canadian Environmental Assessment Act*
- o Public outreach

# Broader goals for Health Canada's contaminated sites program:

- o Leadership in risk assessment methods, RA training, and public outreach
- o Move risk assessment methods forward in Canada to catch up with the science
- o To find a better balance between the 'precautionary principle' and evidence-based risk management decision-making

# Health Canada's Risk Assessment Activities

**Guidance**



**Training**

**Advice**



# HC's Risk Assessment Guidance

- o Part 1 – *Federal Contaminated Site Risk Assessments in Canada: Guidance on Human Health Screening Level Risk Assessment (SLRA)*
- o Part 2 – *Health Canada Toxicological Reference Values*
  - Workshops were held March/04 and Aug/04 to review and recommend revisions to parts 1 & 2 of HC's SLRA guidance documents.
  - Revisions are planned for Spring/05
- o Part 3 – *Human health risk assessment peer review guidance & checklist*
- o Part 4 – *SLRA Spreadsheet* (pending translation)

# HC's Risk Assessment Guidance (cont'd)

- o *Other guidance documents in development*
  - o SLRA guidance on vapour intrusion
    - o CCME CWS PHCs and/or ARBCA and/or other...?
  - o Complex SSRA for Chemicals
    - o Probabilistic RA, bioavailability/bioaccessibility, etc.
  - o Complex SSRA for Radiologicals
  - o Complex SSRA for Microbiologicals
  - o Guidance on sampling backyard produce and wild vegetation used as food
  - o Guidance on assessing risks posed by remedial technologies
    - o related to EIA of federal contaminated site risk management plans under CEAA

# HC's Risk Assessment Training

- **6 seminars (5 Eng / 1 Fr) on 'RA 101' delivered to staff of Custodial departments and others:**
  - **Halifax, Montreal, Ottawa, Toronto, Edmonton, Vancouver**
  - **215 staff of federal departments/agencies**
  - **70 staff of provinces, territories, municipalities & academic institutes**
- **Beta tested a 3 day hands-on course in probabilistic RA**
  - **Delivered to HC RA staff (fine tuning in preparation for delivery to custodial department staff)**

# HC's Risk Assessment Training (cont'd)

- **Plans for Fall/Winter 2004 & Winter/Spring 2005:**
  - **Ten 2.5 day hands-on courses in probabilistic risk assessment to be delivered to staff of custodial departments and others.**
  - **Halifax, Montreal, Ottawa/Toronto, Calgary/Edmonton, Vancouver**
  
- **Plans for April-June 2005 (next fiscal year):**
  - **Five 1 day training sessions in the use of HC's SLRA Spreadsheet**
    - **Halifax, Montreal, Ottawa/Toronto, Calgary/Edmonton, Vancouver**
  - **Training seminars on Public Outreach**

# HC's Science and Research Activities & Plans

- **Comparison of provincial RA guidance**
- **Does ARBCA = CWS PHC?**
- **Database on natural levels of metals in Canadian soils**
- **Bioavailability/Bioaccessibility**
- **Amortization in cancer risk assessment**

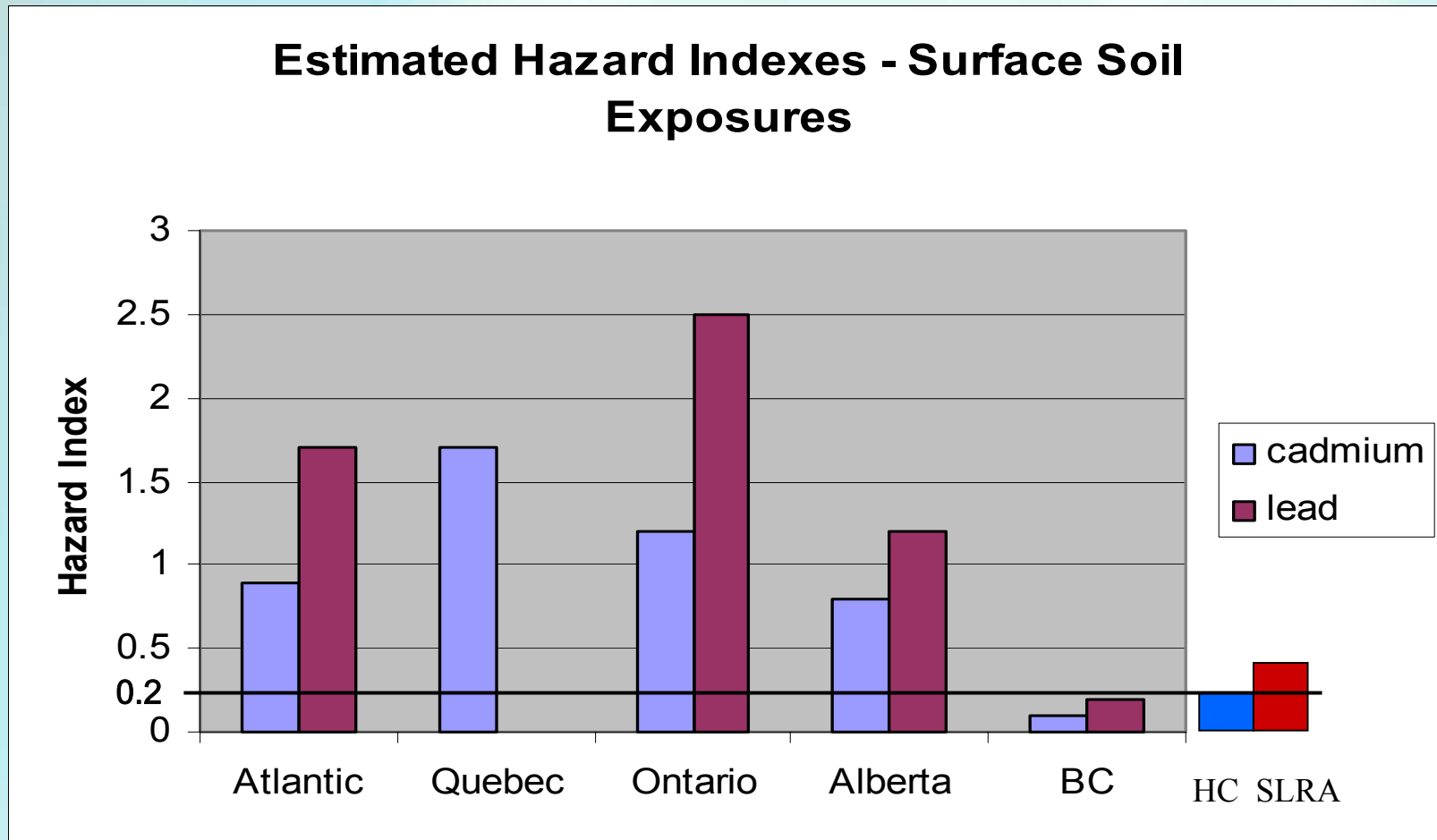
# HC's Science and Research Activities & Plans (cont'd)

- o Comparison of provincial RA guidance
  - o Does HC need to standardize RA methods for federal sites?
    - o HC must be able to compare the relative risks of numerous sites from multiple provinces in order to rank sites from highest to lowest relative risk
  - o Can RA results from one province (the province of site location) be directly compared to sites from other provinces?

# HC's Science and Research Activities & Plans (cont'd)

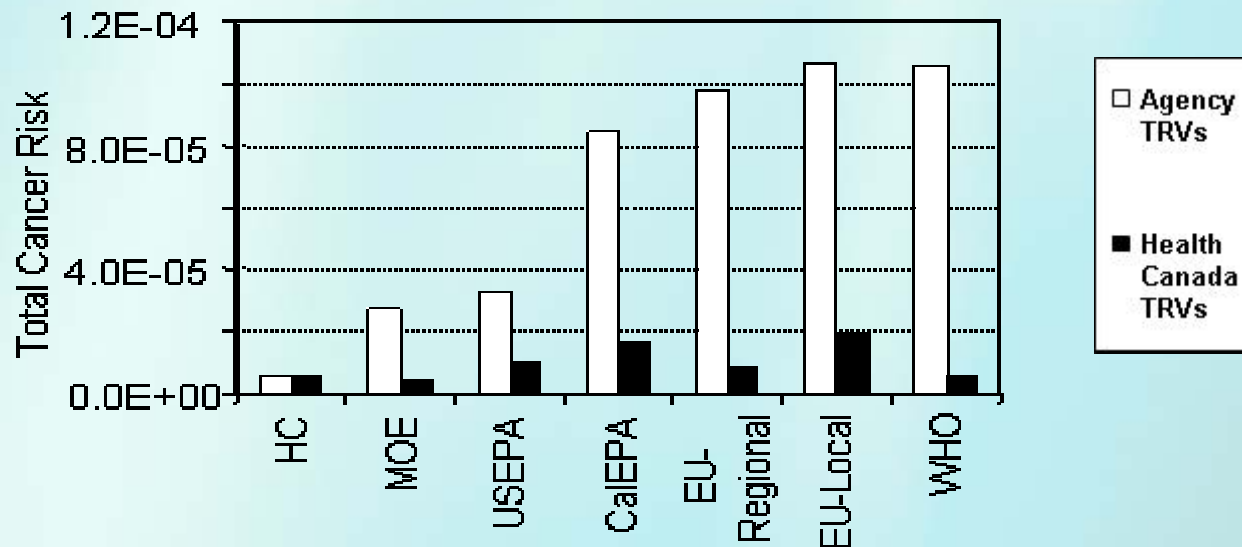
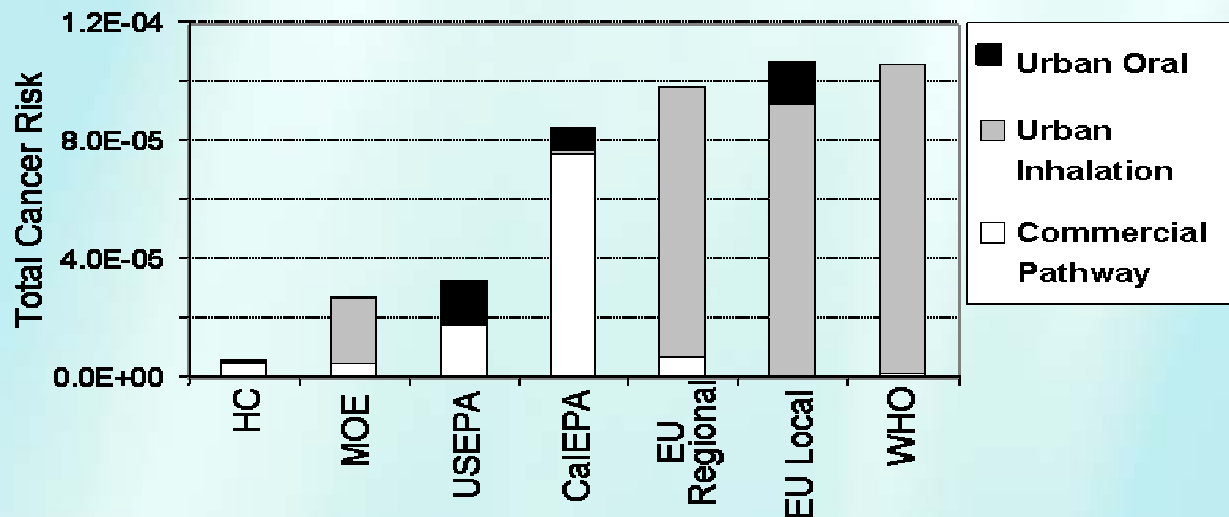
- o Comparison of provincial RA guidance
  - o Devised a hypothetical residential site contaminated with As, Cd, Pb, PHCs, BTEX
  - o Commissioned Dillon Consulting to apply RA methods from Atlantic, Quebec, Ontario, Alberta, & BC

# Why standardize RA methods? Inter-provincial differences ...



# Why Standardize RA methods?

## International comparison in estimated B(a)P risks (from Jones-Otazo et al., 2004)

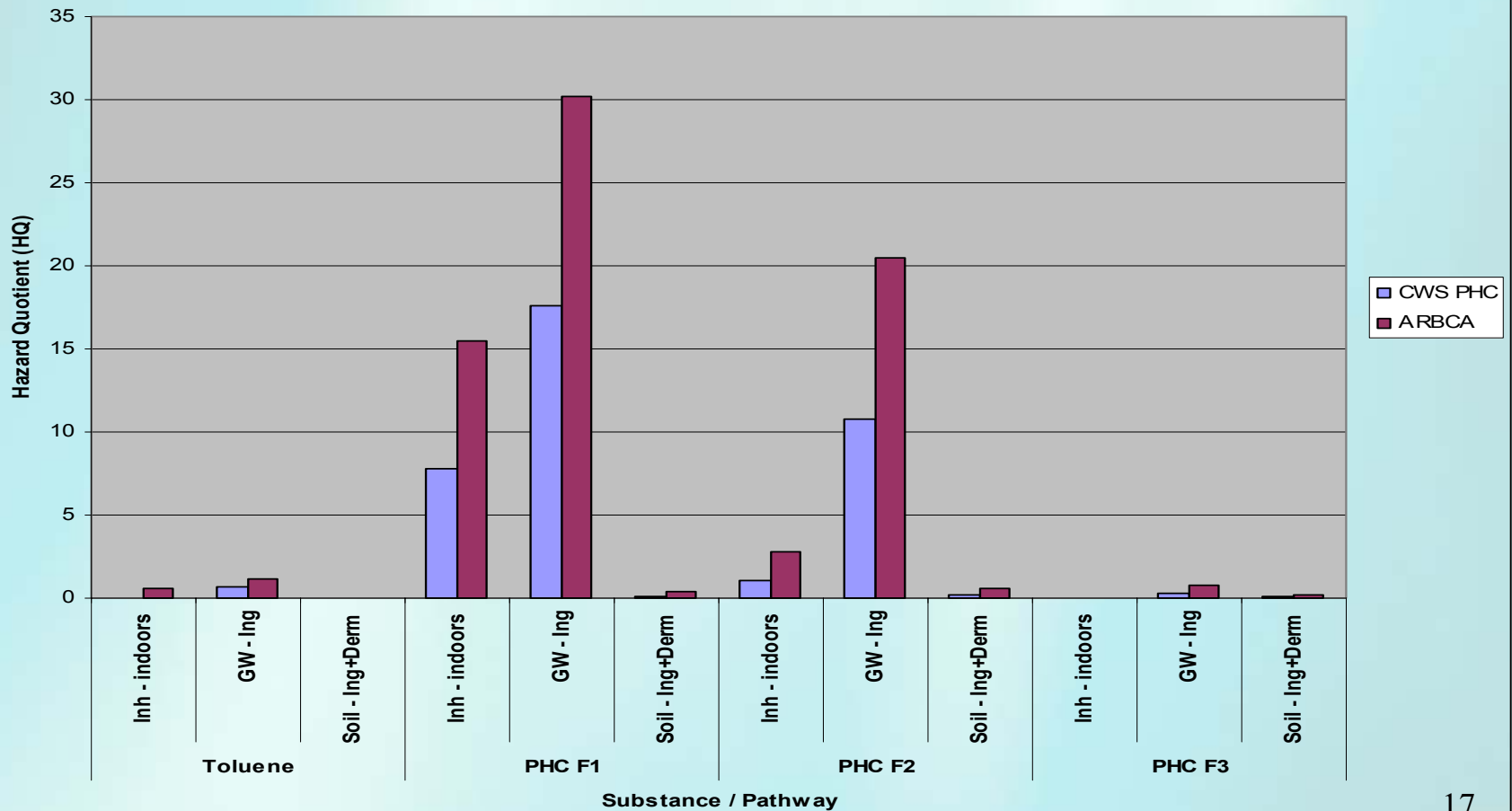


# HC's Science and Research Activities & Plans (cont'd)

- **Does ARBCA = CWS PHC? [And beyond...]**
  - **Comparison, part 1 (MGI Ltd):**
    - Comparison of Tier 1 guidelines and Tier 2 remedial objectives
    - Comparison of underlying approaches, equations, assumptions, etc.
  - **Comparison, part 2 (MGI, Meridian, Golder):**
    - Comparison of HQs (TEX & other PHC) and cancer risks (benzene)
    - ARBCA, CWS PHC, vapour intrusion model with state-of-the-art science
  - **Critical review of the CWS PHC (Meridian)**
    - What happens to Tier 1 guidelines if best available science and data applied?
  - **Re-evaluation of the toxicity of low molecular weight petroleum hydrocarbons (C6 to C10) (Equilibrium, GlobalTox, Wilson Sci.)**
  - **What does the latest science suggest for vapour intrusion modelling? (Golder)**
    - In association with the BC Science Advisory Board on Contaminated Sites

# HC's Science and Research Activities & Plans (cont'd)

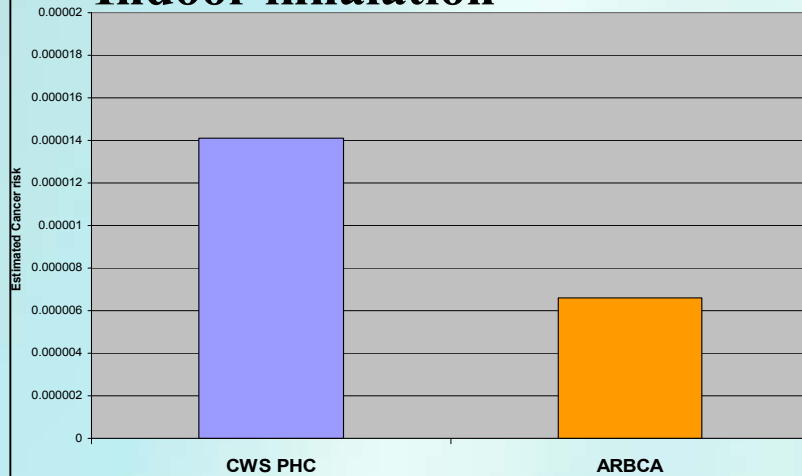
o Does ARBCA = CWS PHC?  
Non-cancer hazard quotients [toluene, F1, F2, F3]



# HC's Science and Research Activities & Plans (cont'd)

o Does ARBCA = CWS PHC?  
Benzene cancer risk estimates

**Indoor inhalation**



**Soil ingestion + dermal**



 = CWS  
 = ARBCA



**Ground water ingestion**

# HC's Science and Research Activities & Plans (cont'd)

- o Database on natural levels of metals in Canadian soils
  - o GSC was commissioned to compile all available federal and provincial soil geochemistry data into a 'meta-database'.
  - o GSC is developing a stand-alone, web-accessible (eventually) database to guide risk assessment practitioners and site managers to available references containing data on background levels of metals in Canadian soils

# Geologic Survey of Canada (GSC)

## Compilation of Soil and Till Geochemistry Metadata for Canada

The screenshot shows a web browser window with the title "Soil & Till Geochemistry Compilation". The page header includes the "Earth Sciences Sector" logo and the "Geological Survey of Canada" name. The main content area features the title "Canadian Metadata Compilation Soil and Till Geochemistry" and a sub-header "Open File XXXX". Below this are four buttons: "Report", "Maps", "Bookstores", and "Read Me". At the bottom left, there are logos for the Government of Canada, Adobe Get Reader, and Adobe. A "Details:" label is positioned above a large white rectangular area. The footer contains the Canadian flag, the text "Natural Resources Canada / Ressources naturelles Canada", and the "Canada" logo.

# Compilation of Soil and Till Geochemistry Metadata for Canada

D:\maps\national.htm - Microsoft Internet Explorer

File Edit View Favorites Tools Help

← Back → Search Favorites Media

Address <D:\maps\national.htm> Go Links

**Geological Survey of Canada**

### Metadata Compilation for Soil and Till Geochemistry

Layer Control	
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<input checked="" type="checkbox"/>	Roads
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<input checked="" type="checkbox"/>	Provincial Borders
<input checked="" type="checkbox"/>	Survey Boundaries
<input checked="" type="checkbox"/>	Linked Areas

Move cursor over the Survey map. Survey regions will become highlighted in orange. Click highlighted survey region to view specific Survey areas.

Canada 1867  
GEOLOGICAL SURVEY OF CANADA

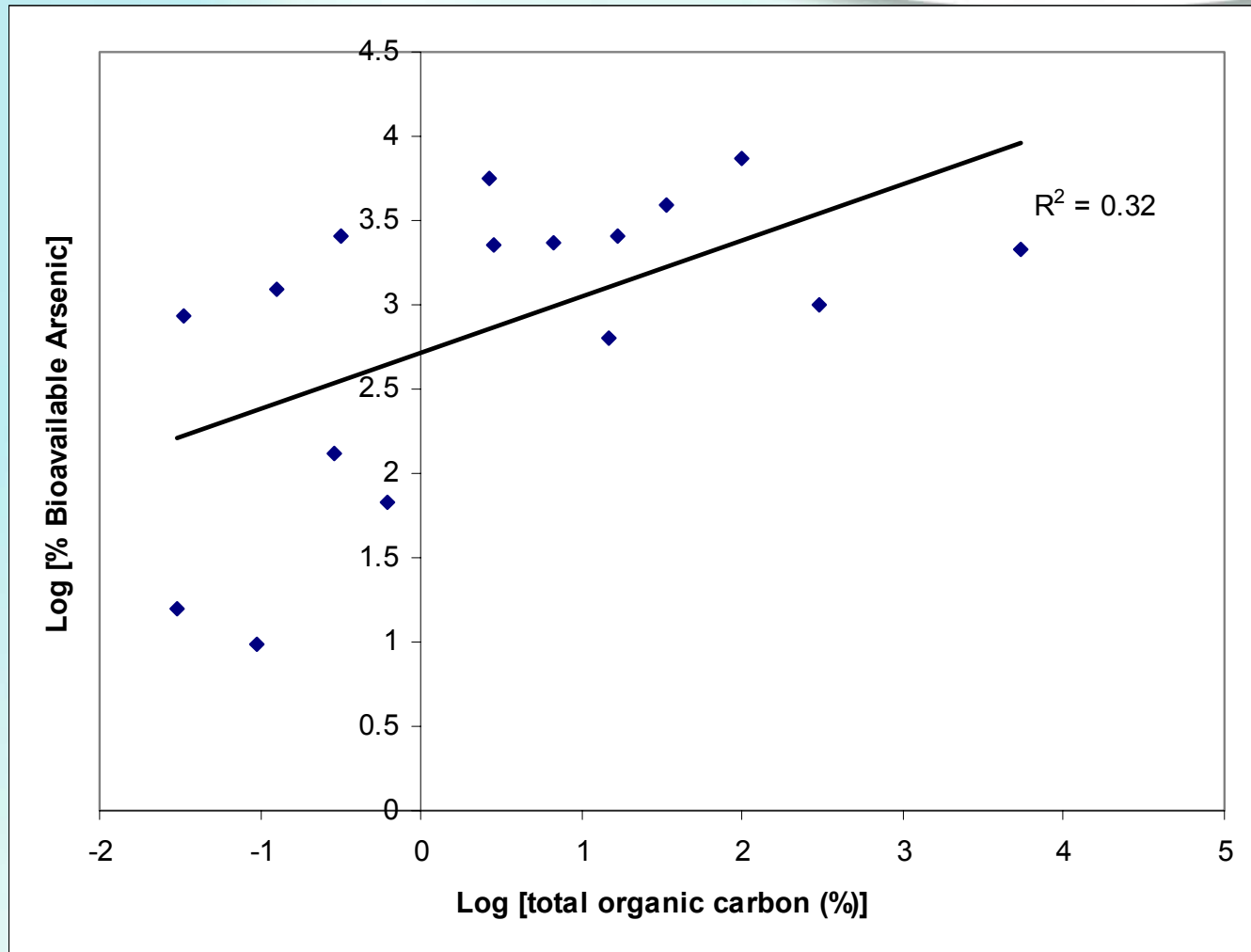
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# HC's Science and Research Activities & Plans (cont'd)

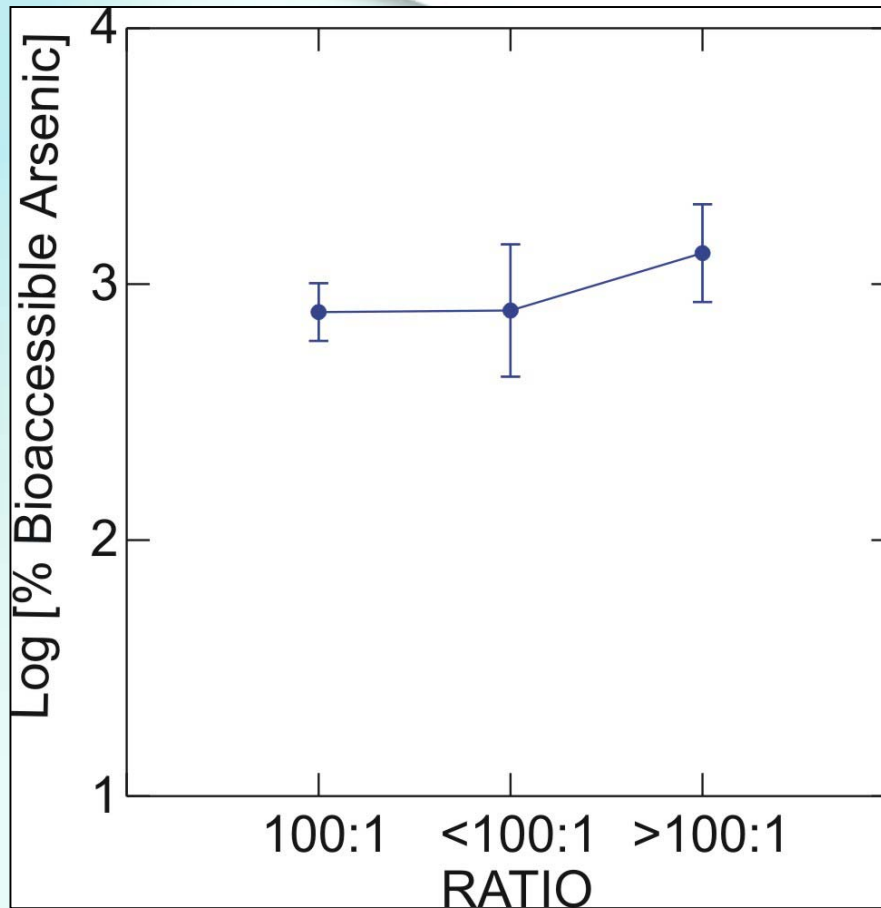
- o Bioavailability/Bioaccessibility of metals from soils
  - o Oral bioavailability
    - o Compilation of data on As (Jacques-Whitford)
      - o Meta-analysis of bioavailability & bioaccessibility data as a function of soil properties, assay methods, and other factors
    - o Preliminary research on the influence of particle size and methodology design on measures of bioaccessibility. (UMA & Royal Roads U)
  - o Establish Canadian working group on bioavailability
  - o Establish standard method(s) for conducting bioaccessibility assays at federal contaminated sites

# Bioavailability as a function of soil organic carbon



(from Jacques Whitford, 2004)

# Bioavailability as a function of assay design

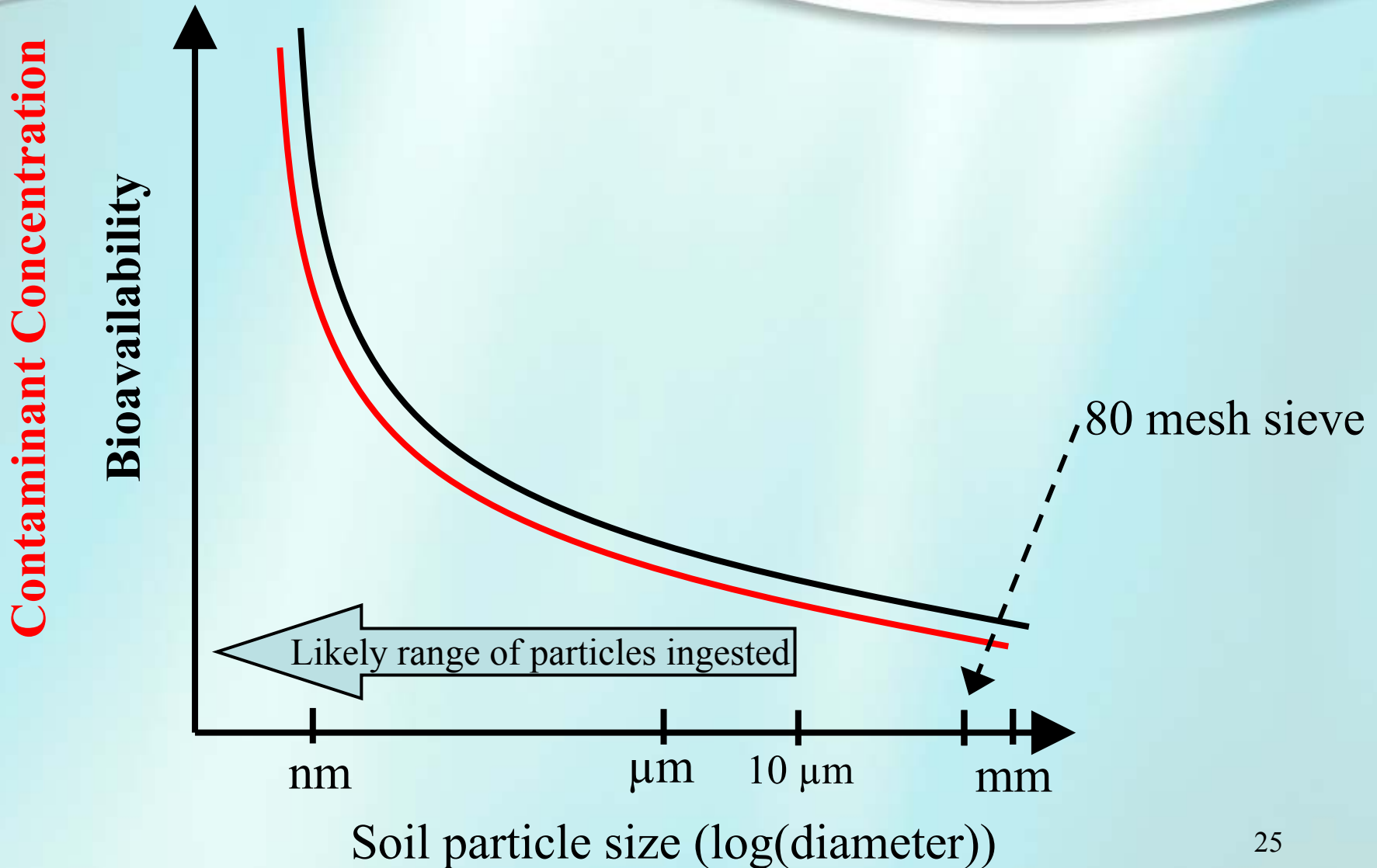


(from Jacques Whitford, 2004)

Ratio of simulated gastric fluid (mL) to soil (g)

*Ratio of gastric fluid volume to ingested soil mass in the human gut  $\approx 10,000:1$*

# Soil concentration and bioavailability as a function of soil particle size



# HC's Science and Research Activities & Plans (cont'd)

- o Bioavailability/Bioaccessibility of metals from soils
  - o Dermal bioavailability
    - o Data are very limited on dermal penetration of soil-borne contaminants through human skin
    - o HC is initiating research on the *in vitro* dermal penetration of soil-borne contaminants through excised *viable* human skin
    - o Dr. Rick Moody, Environmental and Occupational Toxicology Division, Health Canada

# HC's Science and Research Activities & Plans (cont'd)

- o Bioavailability/Bioaccessibility of metals from soils
  - o Respiratory bioavailability
    - o For non-volatile substances, inhaled particulate-borne dose is often added to ingested and dermal doses to derive total dose.
    - o Inhalation bioavailability is routinely assumed to be 100%
    - o Should bioavailability adjustments be applied to inhaled dose in federal contaminated site risk assessments?
    - o If so, how?
      - o Solubility of particulate contaminants in simulated lung fluid
        - o Applied to some occupational contaminants,
        - o Applied to some radio-active substances
    - o ***Critical Review of the Application, Methods and Interpretation of Lung Fluid Solubility Assays in Risk Assessment***
      - o Why are they used?
      - o How are they conducted?
      - o What do they mean?

# HC's Science and Research Activities & Plans (cont'd)

- o Amortization in cancer risk assessment
  - o Def'n: the pro-rating (averaging) of less-than-lifetime exposures over estimated life expectancy to derive a lifetime average daily dose
  - o Sometimes considered 'dose dilution'.
  - o Is the practice of amortization valid and scientifically defensible?

# HC's Science and Research Activities & Plans (cont'd)

- o Amortization in cancer risk assessment
  - o Tradition maintains the practice of amortization but the available theory and empirical data suggest that it has a high likelihood of being wrong
  - o Available empirical evidence suggests that amortization of less-than-lifetime exposures may have a greater likelihood of under-estimating cancer risks than over-estimating those risks.
  - o Strong and repeated evidence to suggest that early life stage and late life stage less-than-lifetime exposures **DO NOT** present equivalent risks
  - o All previous reviews of this issue seem to agree that simple amortization is flawed

# Summary and Conclusions

- **HC's contaminated sites risk assessment program is off to a running start**
- **HC is working to move risk assessment practices and procedures toward better reflecting current science and understanding**
- **Research on bioavailability will contribute to a better balance between the precautionary principle and evidence-based risk management**
- **HC is not only committed to 'public outreach' but also to 'stakeholder outreach'**
  - **Reports and investigations of issues critical to risk assessment practices and procedures will be readily available (watch our website)**
  - **Stakeholder consultations, to discuss and debate the science, will be conducted prior to the implementation of *controversial* advancements in risk assessment methods for federal contaminated sites**