



# Use of Geoscience in Population Health Risk Assessment: Workshop Summary

Daniel Krewski, PhD, MHA  
McLaughlin Centre for  
Population Health Risk Assessment

Ottawa, Ontario  
November 28, 2007



**McLaughlin Centre for Population Health Risk Assessment**

# Welcome

*André Lalonde, University of Ottawa*

---

- Unique workshop focusing intersection between geoscience and population health
- Linkage between geology and health exemplified by asbestos: need for greater interaction between mineralogists and health scientists



**McLaughlin Centre for Population Health Risk Assessment**

# Workshop Objectives

*Andy Rencz, Natural Resources Canada*

---

- Geoscientist able to characterize the surficial geochemical environment
- Most elements (e.g., copper) are required to sustain health
- Workshop objective is to explore linkages between geoscience and population health (*action plan*)



*“How can geoscience be integrated into public health?”*



**McLaughlin Centre for Population Health Risk Assessment**

# What is Geoscience?

*Rod Klassen, University of Ottawa*

---

- Biodiversity and health related to properties of geosphere
- Minerals particularly important for population health: essential elements demonstrate U-shaped dose-response curves
- Challenge is to link properties of geosphere to population health
- Measurement protocols for geochemical measurements important in reducing uncertainty in exposure assessment
- Enhance certainty in risk assessment:
  - stable, predictive framework (geochemical maps)
  - interpretive tools (measurements, process models)
  - predictive models (glacial transport of arsenic)



**McLaughlin Centre for Population Health Risk Assessment**

# What is Population Health Risk Assessment

*Daniel Krewski, University of Ottawa*

---

- Integrated framework for risk management and population health
- Environmental radon: significant contributor to lung cancer burden
- *Opportunity: use NRCan uranium maps to predict radon release from soils, and link to lung cancer risk?*
- Air pollution: spatial analyses have linked particulate air pollution to mortality
- *Opportunity: use satellite imaging to predict ground level air pollution levels, then evaluate population health impact with more complete exposure data?*



*“In God we trust . . . but all others need data.”*



**McLaughlin Centre for Population Health Risk Assessment**

# Geoscience Databases

*Eric Grunsky, Natural Resources Canada*

---

- Large amount of geochemical survey data available from federal, provincial, and territorial governments:
  - Geology of Canada
  - Radioelement map
  - Ecoregions
  - Geochemical data
- NRCan Geoscience Data Repository permits downloads of wide range of metadata
- Need to consider sampling density in assessing spatial variability
- Much of the data is available at minimal or no costs for research purposes



**McLaughlin Centre for Population Health Risk Assessment**

# Geoscience and Population Health

*Dave Smith, US Geological Survey*

---

- **Earth materials:**
  - generated by natural processes (volcanic ash)
  - human disturbance of geological materials (mining)
  - anthropogenic materials (urban particulates)
- **Link earth science and biomedical science**
- **Toxicity depends on: exposure pathways, intensity/duration of exposure, material characteristics**
- **Interdisciplinary methods needed to study potential health effects of earth materials**
- **Collaboration between earth and health sciences communities key to success**



# Use of Geoscience in Health Risk Assessment

## *Mark Richardson, Health Canada*

---

- Applications of geochemical data:
  - determining daily intakes (using air, water, food, and soil concentrations)
  - CCME Soil Quality Guidelines (for threshold and nonthreshold elements)
  - screening of federal contaminated sites (compare measured concentrations with CCME guidelines, *as well as natural background*)



# Panel Discussion: Development of a Canadian Health Geoscience Initiative

---

- Panelists:

- André Lalonde, UOttawa (Panel Chair)
- Dave Smith, USGS
- Geneviève Béchard, NRCan
- Mark Hannington, UOttawa
- Michael Jerrett, University of California at Berkeley
- Nancy Doubleday, Carleton University
- Pat Rasmussen, Health Canada & UOttawa



# Panel Discussion: Dave Smith

---

- Large number of chemicals in the human environment, the potential risks of which have not yet been fully assessed
- Cancer clusters require investigation in geospatial terms (exposure biomarkers may be useful in this regard)



*“Ignorance outweighs knowledge at every point of the risk assessment process.”*



# Panel Discussion: Geneviève Bécharde

---

- NRCan programs seek to reduce risk
- Framework for multi-hazard risk assessment needs to include health
- Understand needs of non-traditional users of NRCan data
- Use both geoscience and public health risk assessment lens to identify priorities
- Key questions:
  - establish priorities
  - explore mechanisms
  - train next generation of scientists
- NRCan will report future results against ecosystem risk management (human health



# Panel Discussion: Harold Foster

---

- At least 14 minerals that are essential to human health
- Risk of being deficient in one or more of these minerals depends very much on location
- Being deficient in selenium has implications for cancer, heart disease, and viral conditions
- Selenium soil concentration are affected by human activity, such as burning of fossil fuels
- First order diseases associated with deficiency in one element occur over broad geographic areas, with second order diseases involving deficiencies in two elements nested within these broad areas



# Panel Discussion: Mark Hannington

---

- Canadian shield contains the bulk of Canada's *mineral wealth*, which will be exploited in the coming decades because of global demand for natural resources
- About 250 active mines (and associated communities) in the Canadian shield
- Mining industry very advanced in health and environmental risk assessment
- *Opportunity: assess community health in mining communities in the Canadian shield*



# Panel Discussion: Micheal Jerrett

---

- Association of disease with space and place (air pollution asthma in Hamilton):
  - elevated exposure?
  - more susceptible?
  - maladaptation to environment?
- Use of GIS in spatial health studies allows to:
  - see the data
  - integrate data from different sources
  - conduct interactive data analyses
  - make use of very large data sets
  - increase speed of delivery
- GIS currently a small component of population health, that warrants expanded application



# Panel Discussion: Nancy Doubleday

---

- Need to involve public in geoscience and population health
- Think about reallocation of responsibility for risk, through , risk sharing through participatory risk management (motivated by need to manage costs more effectively)
- *Opportunity: Geocoordinates for property ownership will provide new linkages to space and place*



*“Need to put the ‘public’ in public policy and public health.”*



# Panel Discussion: Pat Rasmussen

---

- Role of geoscience in environmental health:
  - determine source and nature of each environmental stressor
  - assess exposure
  - measure the effects
  - apply appropriate controls
- Challenges in exposure assessment:
  - multiple exposures
  - distinguish natural vs anthropogenic exposures
  - exposure measurement error
  - spatial and temporal variability



# Panel Discussion: Participants

---

- How should we handle legacy of (some 10,000) orphan mine sites? [some mining communities outside Canada have become world heritage sites]
- Intra-urban variation on geospatial variables needs to be considered (80% of population lives in urban areas)
- *Opportunity: conduct a case study where considerable information is already available, such as lead and zinc near Red Dog mine in Alaska* [data available even prior to development of mine]
- Confidentiality provisions can limit use of health records in health geoscience research [privacy provisions are essential, and need to be respected in appropriate ways in health research]



# Panel Discussion: Participants

---

- Environmental data may also present confidential concerns [e.g., sampling of well water could affect property values, and also warrants consideration of privacy] [more generally, how should sampling on private land be addressed?]
- Geoscience can be helpful in finding [geological] solutions to health risk management problems
- What can we learn internationally? [South America, Mexico]
- Mining industry may have data that could be useful for health geoscience research [consult Mining Association of Canada about collaborative opportunities?]



*“Informed consent is the solution to ethical concerns.”*



# Next Steps

---

- Post presentations at workshop on McLaughlin Centre website  
[www.mclaughlincentre.ca](http://www.mclaughlincentre.ca)
- Prepare and post workshop report
- Explore collaborative research opportunities identified at the workshop
  - radon mapping, linked to lung cancer risk
  - community health risk assessment in Canadian Shield, linked to mining activities
  - satellite imaging to predict air pollution concentrations, linked to air quality health index
- Metal Workshop scheduled for May 6, 2008



Some well deserved

Thank You's!

# Thanks to . . .

---

- Organizing Committee
- Speakers and Panelists
- Participants
- Sponsors
  - Natural Resources Canada
  - McLaughlin Centre
  - Canadian Shield Research Institute



**McLaughlin Centre for Population Health Risk Assessment**

*Adjourned!*

