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Health Canada Perspective:

The Role of Geochemical Data in CCME Soil Quality Guidelines and Human Health Risk Assessment

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Health Canada's Use of Geochemical Data Under the Federal Contaminated Sites Action Plan (FCSAP)

- Human Health Risk Assessments
- Soil and Sediment Quality Guidelines (SQG and SedQG) Development
- Estimated Daily Intake (EDI) Calculations





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Human Health Risk Assessment

- Background soil data used in Human Health Risk Assessment for:
 - Screening/classification (preliminary, conservative estimation)
 - Risk evaluation (site specific)
 - Risk management (preliminary, conservative or site specific)
 - Aid in setting site-specific remediation goals
- Many contaminants, particularly metals, are naturally occurring. Natural levels can exceed Canadian Council of Ministers of the Environment (CCME) soil quality guidelines and other generic guidelines without representing anthropogenic contamination.





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Human Health Risk Assessment

Background soil concentrations play an important role in determining whether a site may be contaminated, particularly for natural elements.

Screening of Federal Contaminated Sites

- Compare site chemical concentrations to data from local or regional surveys of background soil quality in uncontaminated areas.
- On-site levels considered to be consistent with background when maximum concentration of a chemical of potential concern (COPC) is \leq to a representative statistic for background concentration.
- If concentrations of site COPCs are representative of background, then the site may not be contaminated - despite the fact that environmental quality guidelines are exceeded.





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Human Health Risk Assessment

Requirements for HH risk assessment:

- a standardised approach to assessing the availability and screening (is data appropriate?) of background data
- both regional and national geochemical data
- data from surface soils (human health layer)
- guidance on how to best collect, analyse and use data





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Soil Quality Guideline (SQG) Development

- Health Canada develops SQGs for human health for the CCME
- Background soil values are required to calculate SQGs for human health
- SQGs are used in screening for Contaminants of Potential Concern (COPCs) in risk assessments. COPCs can be:
 - Substances which exceed SQGS and
 - Substances which exceed natural regional (local) background
 - Substances for which no human health-based background data exist
- SQGs may be used as clean-up goals at contaminated sites





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Soil Quality Guideline Development

- Presently, SQGs are prepared using a **single** national background concentration that is typical of most soils in Canada.
- In specific locations with unusually high natural background concentrations that exceed SQG, site-specific guidelines that consider the unique geological characteristics of the particular locations should be calculated.





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Soil Quality Guideline Development

- SQGs for relevant geographic units may be more appropriate.
 - A single national CCME SQG is hypothetical at best as variability in soil concentrations across different regions can be extremely high
 - More appropriate geographic units could be Ecozones/ Ecodistricts, geologic provinces/formations, watersheds, etc.
 - Availability of regional data for other media (especially water) must also be considered





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Soil Quality Guideline Development: CCME Equations

Threshold (non-carcinogenic) contaminants:

- the total exposure from direct soil pathways should not generally exceed typical background soil exposures by more than 20% of the residual tolerable daily intake (RTDI = TDI-EDI).

$$SQG_{HH} = \frac{(TDI-EDI) \times SAF \times BW}{[(AF_G \times SIR) + (AF_S \times SR) + (AF_L \times IR_S) \times ET_2] \times ET_1} + BSC$$





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Soil Quality Guideline Development: CCME Equations

Non- threshold contaminants:

For chemicals identified as a non-threshold by Health Canada, then guideline should represent an incremental risk from soil exposure of no more than 10^{-5} above the background soil concentration.

$$SQG_{HH} = \frac{RSD \times BW}{[(AF_G \times SIR) + (AF_S \times SR) + (AF_L \times IR_S) \times ET]} + \boxed{BSC}$$





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Soil Quality Guideline Development: CCME Equations

AF_G : Absorption Factor for Gut

AF_L : AF for Lung

AF_S : AF for Skin

BSC: Background Soil
Concentration

BW: Body Weight

EDI: Estimated Daily Intake

ET: Exposure Term

IR_S : Inhalation Rate for Soil

RSD: Risk Specific Dose

SAF: Soil Allocation Factor

SIR: Soil Ingestion Rate

SQG_{HH} : Soil Quality Guideline for
Human Health

SR: Soil Dermal Contact

TDI: Tolerable Daily Intake





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Health Canada's Science and Research Activities with Geological Survey of Canada

Natural sources and levels of metals in Canadian soils

- Support for the Tri-National soil survey (GSC)
 - Enabled collection of samples from the “public health” layer (top 5 cm)
- Bioaccessibility analysis of soil samples collected through the Tri-national survey

