Using North American Soil Geochemical Landscapes Project Data in Contaminated Site Risk Assessment

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Estimates of Daily Intake

Guidelines Development

Risk Assessment

Research

Estimated Daily Intake (EDI)

Measurements of background concentrations are incorporated in estimates of daily intake. EDI's are in turn incorporated into the development of guidelines.

$$EDI = \{([C_{air}] \times IR_{air}) + ([C_{H_2O}] \times IR_{H_2O}) + (\Sigma[C_{foodi}] \times IR_{foodi}) + ([C_{soil}] \times IR_{soil})\} / BW$$

Soil Quality Guidelines

Background soil concentrations are used in establishing Canada-Wide CCME Soil Quality Guidelines

Threshold elements

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

Non-threshold elements

- $SQG_{HH} = \dfrac{RSD \times BW}{[(AF_G \times SIR)+(AF_S \times SR)+(AF_L \times IRS) \times ET} + BSC$

Explanation of Terms

AF_G	Absorption factor for soil	IR_{air}	Ingestion rate from air
AF_L	Absorption factor for lung	IR_{H2O}	Ingestion rate from water
AF_S	Absorption factor for skin	IRS	Inhalation rate from soil
BSC	Background soil concentration	IR_{soil}	Ingestion rate from soil
BW	Body weight	RSD	Risk specific dose
$[C_{air}]$	Concentration in air	SAF	Soil allocation factor
$[C_{foodi}]$	Concentration in food ingested	SIR	Soil ingestion rate
$[C_{H2O}]$	Concentration in water	SQG_{HH}	Human health soil quality guideline
$[C_{soil}]$	Concentration in soil	SR	Soil dermal contact rate
EDI	Estimated daily intake	TDI	Tolerable daily intake
ET	Exposure term		

Source: Canadian Environmental Quality Guidelines
Canadian Council of Ministers of the Environment, 1999
Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health
Summary of a Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines (CCME 1996a)

Risk Assessment

Understanding spatial patterns in background concentrations may help to better evaluate risks and reduce remediation costs.

Remediation efforts below natural background levels at the site are not cost effective.

Research

Soil samples can be used for further research on specific contaminants or on biochemical processes related to exposure.

- Bioaccessibility - process
- Perchlorate - potential contaminant of concern

Bioaccessibility

Using GSC soil samples, in Vitro tests which measure the amount of contaminants absorbed into the body are being conducted at Royal Roads University.

Bioaccessibility studies use simulations of stomach fluids to break down the soil and estimate absorption results.

Resulting absorption factors can then be built into risk assessment calculations.

PERCHLORATE

Rocket fuel, controversy, and wide-spread contaminant?

By Karen McKendry,

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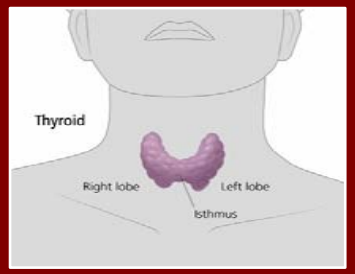
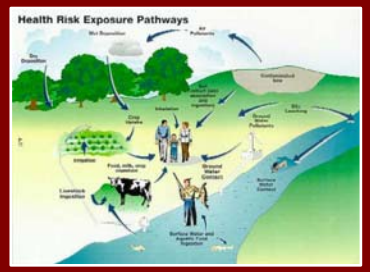
Rocket fuel

- Perchlorate = ClO_4^-
- Used in rocket fuel, munitions, air bags, flares, etc.
- Does not break down readily in environment
- In U.S. extensive dumping of perchlorate associated with Cold War
- Widespread contamination established, but natural sources now found



The Controversy



- Perchlorate is an iodide inhibitor that acts on the thyroid
- RfD = 0.0007 mg/kg bw-day
- Safe level in water: 23 ppb? 1 ppb?
- Billions of $$$ in clean up costs, lawsuits underway
- Other sources: food (lettuces, citrus, melons, soybeans), consumer products (tobacco)

Perchlorate work with GSC

- Perchlorate levels in the Canadian environment are likely extremely low.
- EC has tested for perchlorate in water = less than 1 ppb in drinking water
- HC is testing for perchlorate in foods
- No tests in Canadian soils until now…
- Results: no perchlorate!
- Achieved goal, continue sampling?