

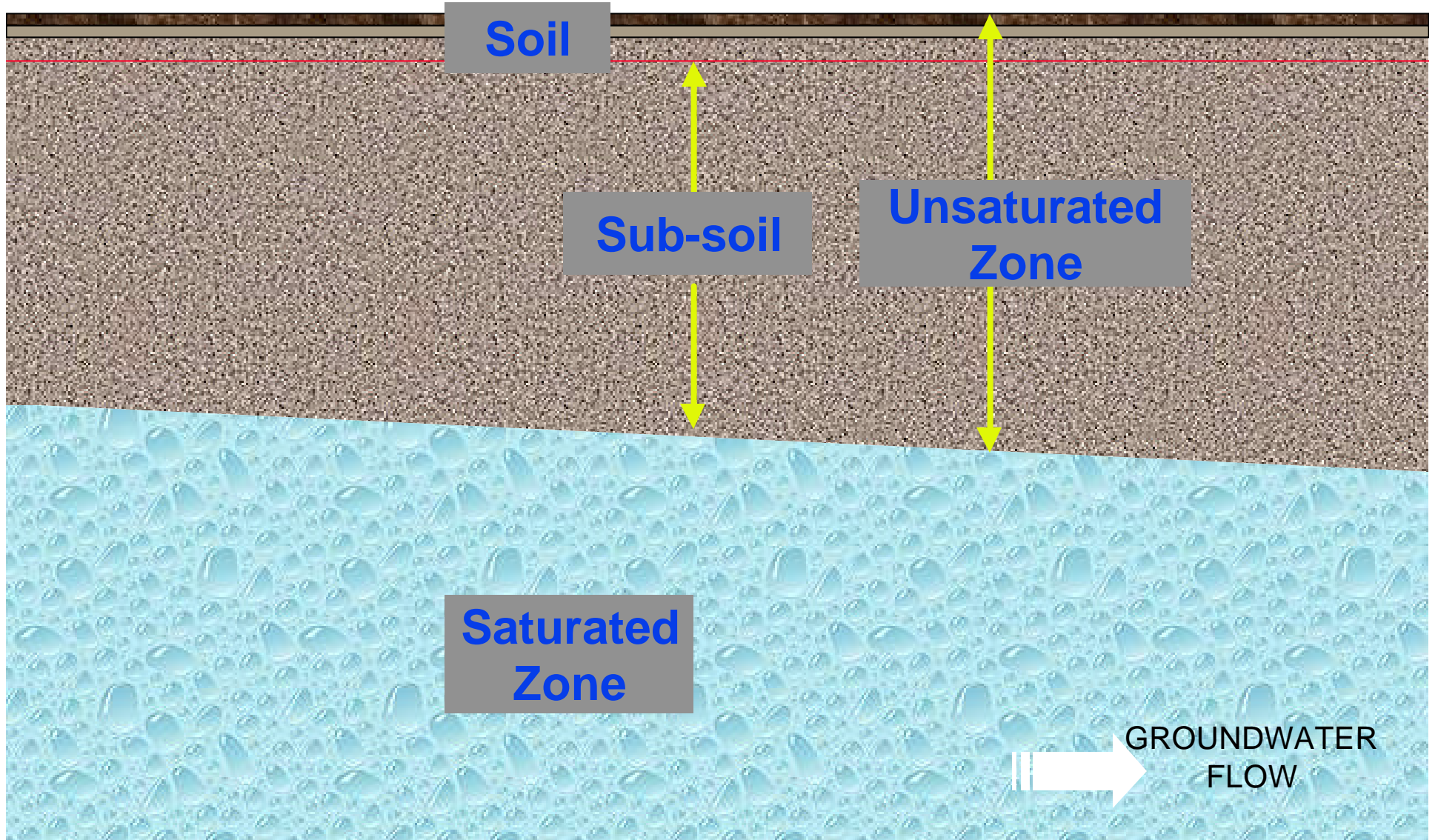
# **Alberta Soil Guideline Development and Relation to CCME Processes**

**Ted Nason**

**Environmental Sciences Division**



# Components of the Geo-Environment



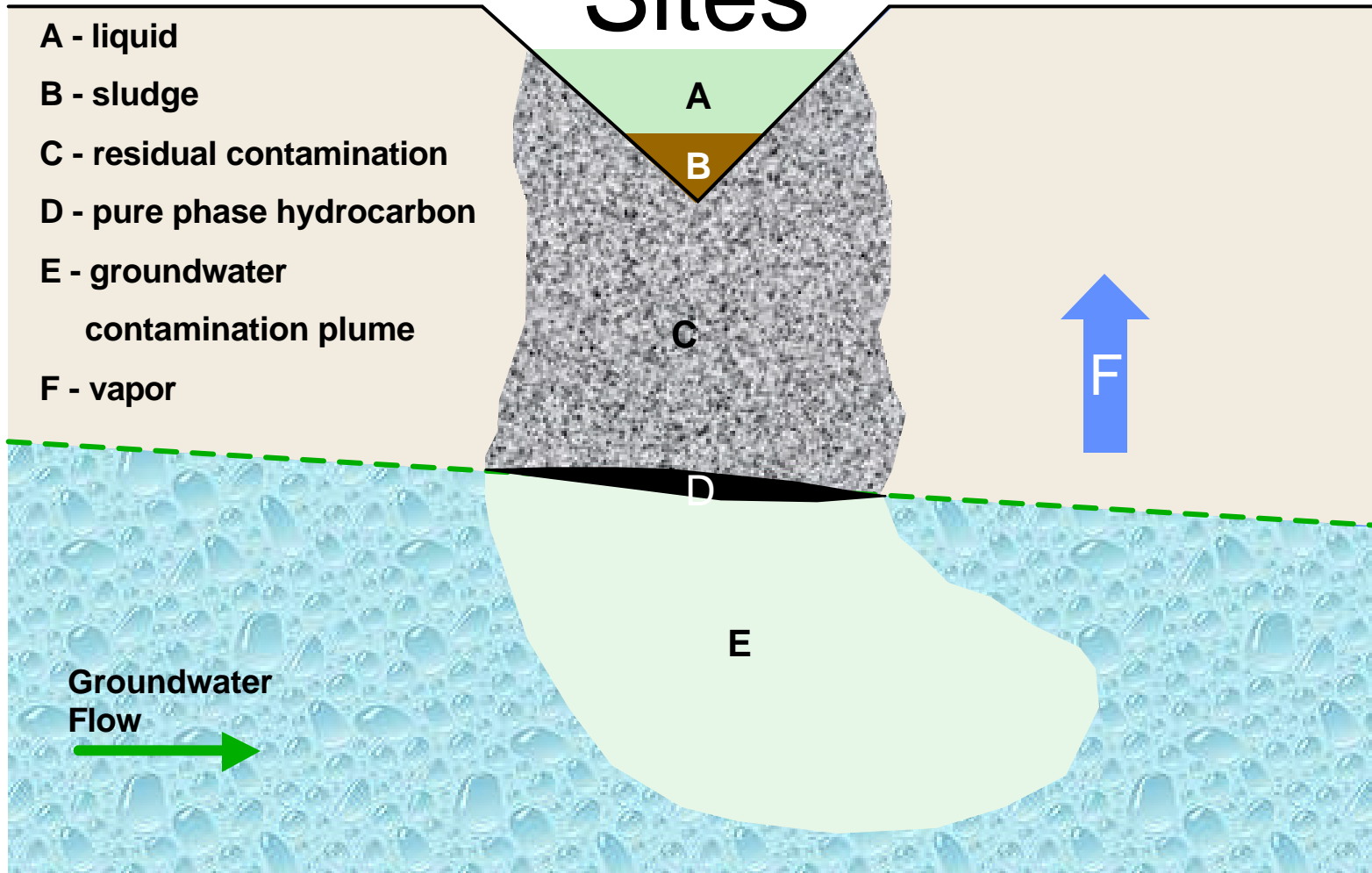
# **Geo-Environmental Quality:**

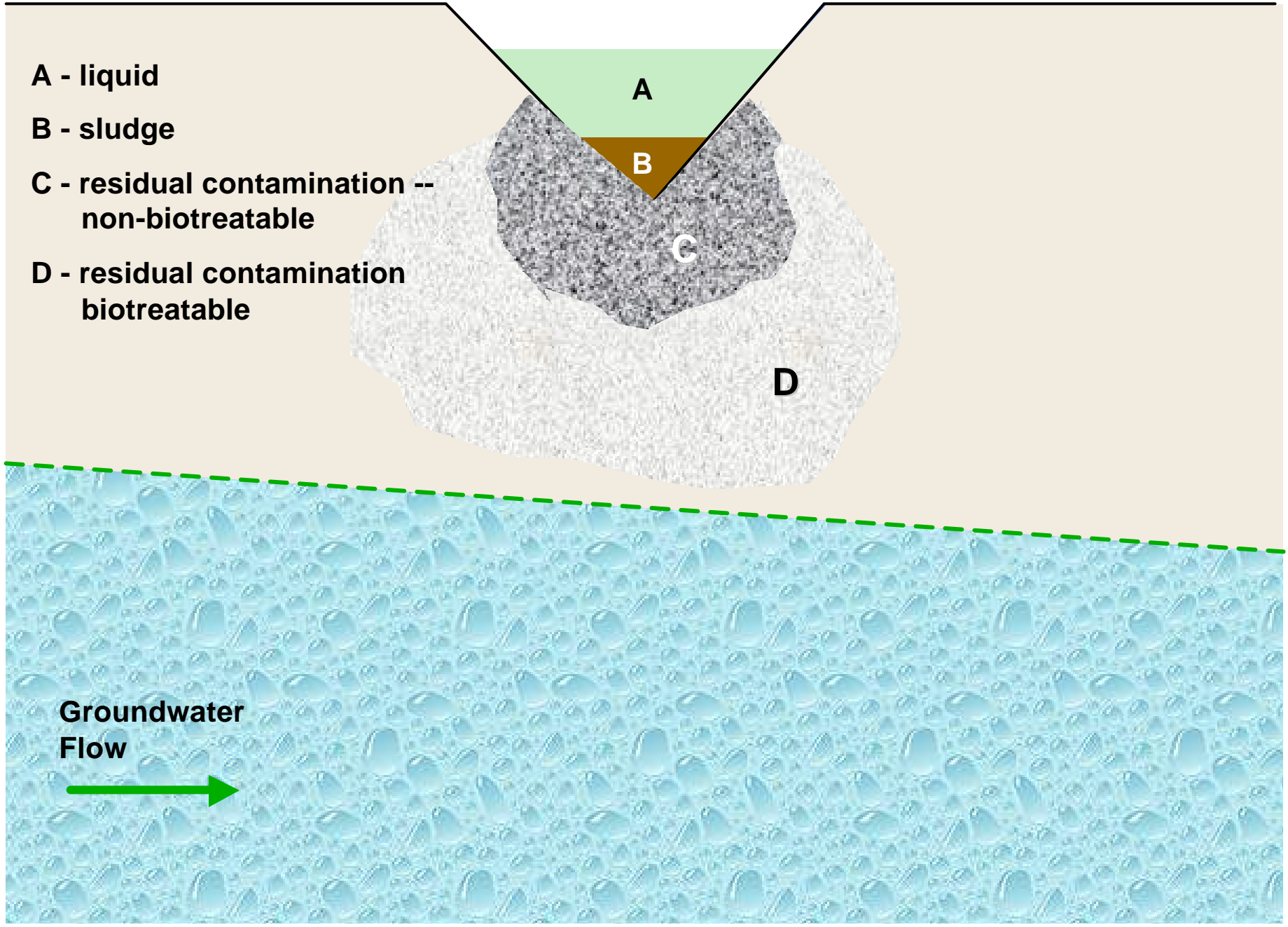
*The ability or suitability of land  
(soil, subsoil, groundwater) to  
support various uses*

# Contaminants of Concern

- Toxic Natural Products
  - benzene, toluene, ethylbenzene, xylenes (“BTEX”), petroleum hydrocarbons (PHC), polycyclic aromatic hydrocarbons (PAH)
- “Heavy” Metals (rare at upstream sites)
  - Cu, Cd, Cr, Hg, Pb etc.
- Other Inorganics
  - sulfur, salts

# Contamination at Upstream Sites





# Contaminant Assessment: 2 approaches

## 1. Guidelines approach

- contaminant concentrations compared to tabular numerical values
- aka: “criteria”, “generic approach”, “remediation objectives”, “Tier 1/ Tier 2”

## 2. Site-specific risk assessment

- assessment based specifically on properties of site, receptors, pathways, contaminants
- aka “Tier 3”
- rigour meets or exceeds Tier 1, 2

# Soil Guidelines and Objectives

## Soil Quality Guidelines (Tier 1)

*Generic numerical concentrations or narrative statements recommended to support and maintain specific uses of soil*

## Soil Quality Objectives (Remediation Objectives, Tier 2)

*Numerical concentrations or narrative statements recommended to support and maintain specific uses of soil **at a specific site***



Likelihood of Adverse Effects



# Guidelines as Benchmarks

*Occurrence of Adverse Effects  
Dependent on Site-Specific Factors*

***Environmental Quality Guidelines***

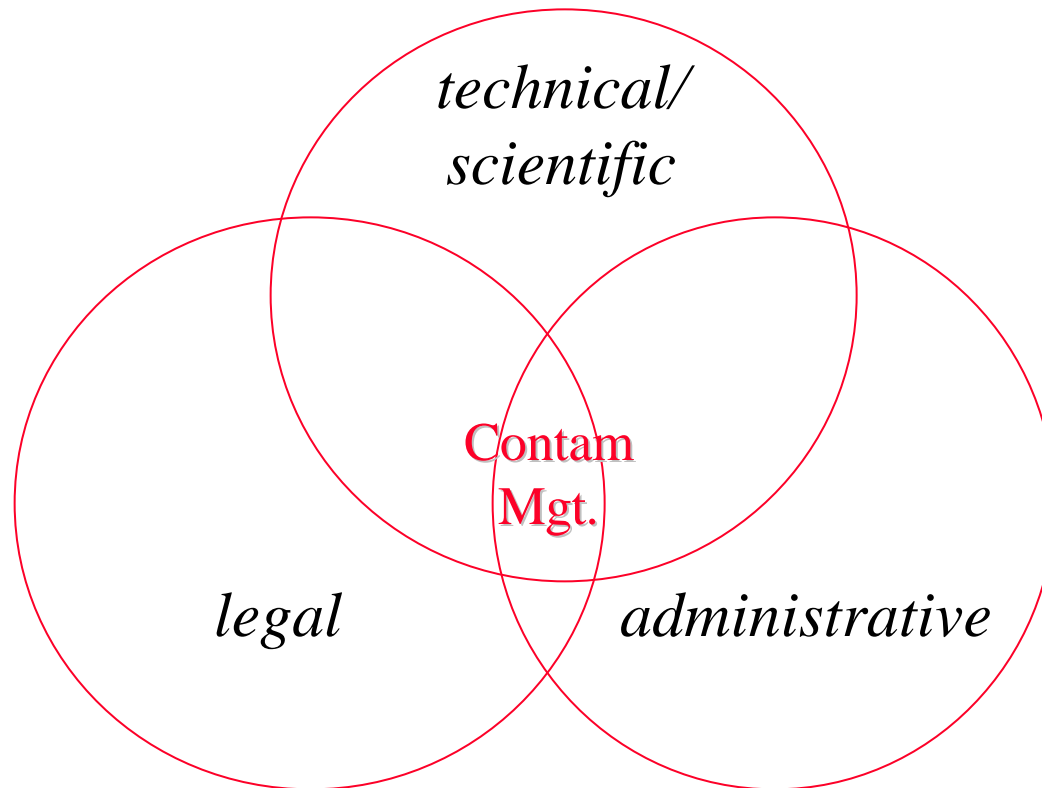
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*No Adverse Effects Predicted*

# Where Does Alberta Get Its Soil and Water Quality Guidelines?

# National Principles/Scientific Tools

## Alberta Policy Framework

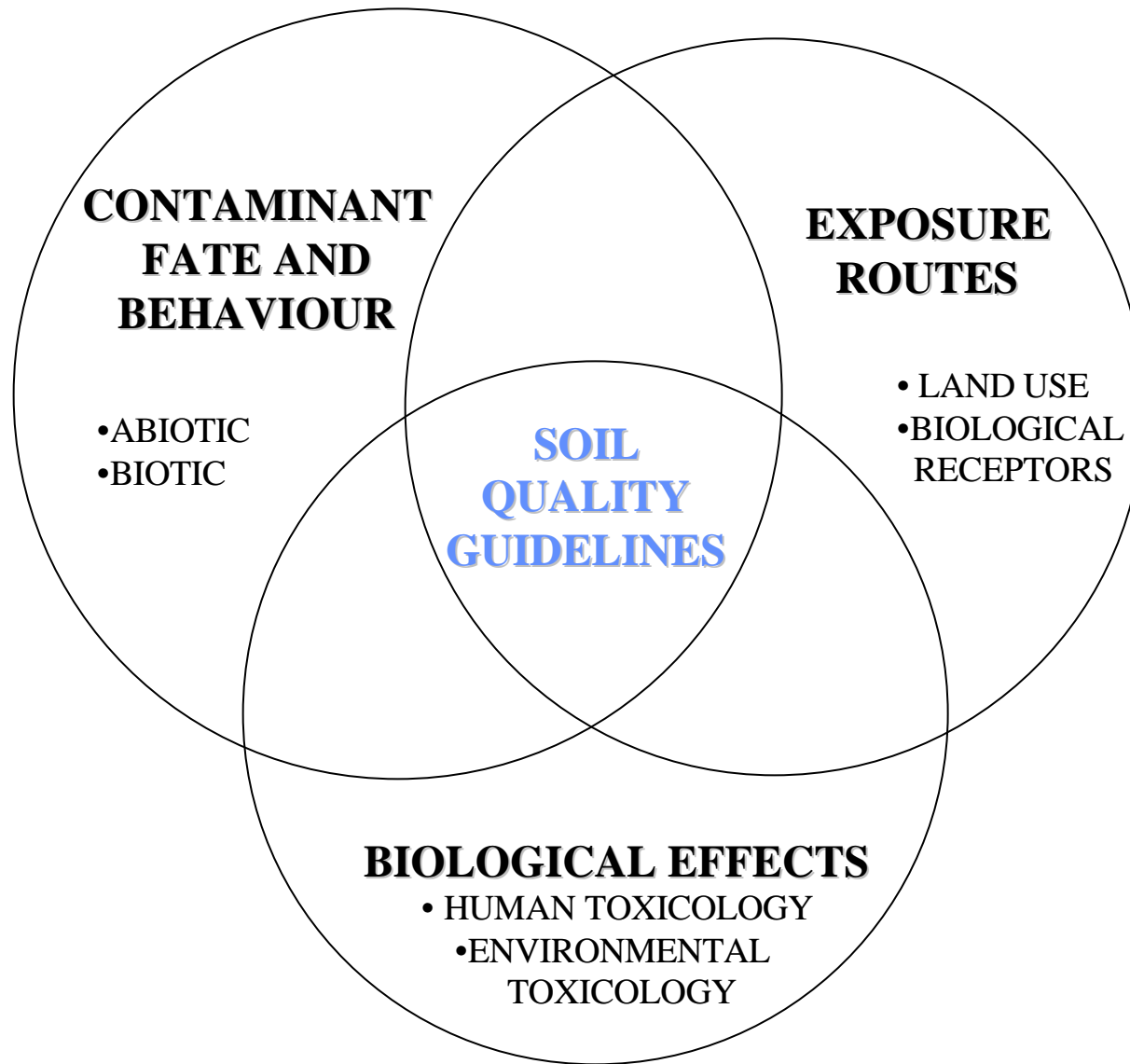


# CCME = Canadian Council of Ministers of the Environment

- **Intergovernmental council**
- **14 ministers of environment**
- **Forum for joint discussion and action**
- **Issues of intergovernmental nature and national significance**
- **Consensus-based decision making**
- **Equal membership, Chair rotates**
- **Collective workplans**
- **historically, voluntary implementation of products**

# CCME 1996 Soil Guideline Development Protocol: *Good Soil Quality*

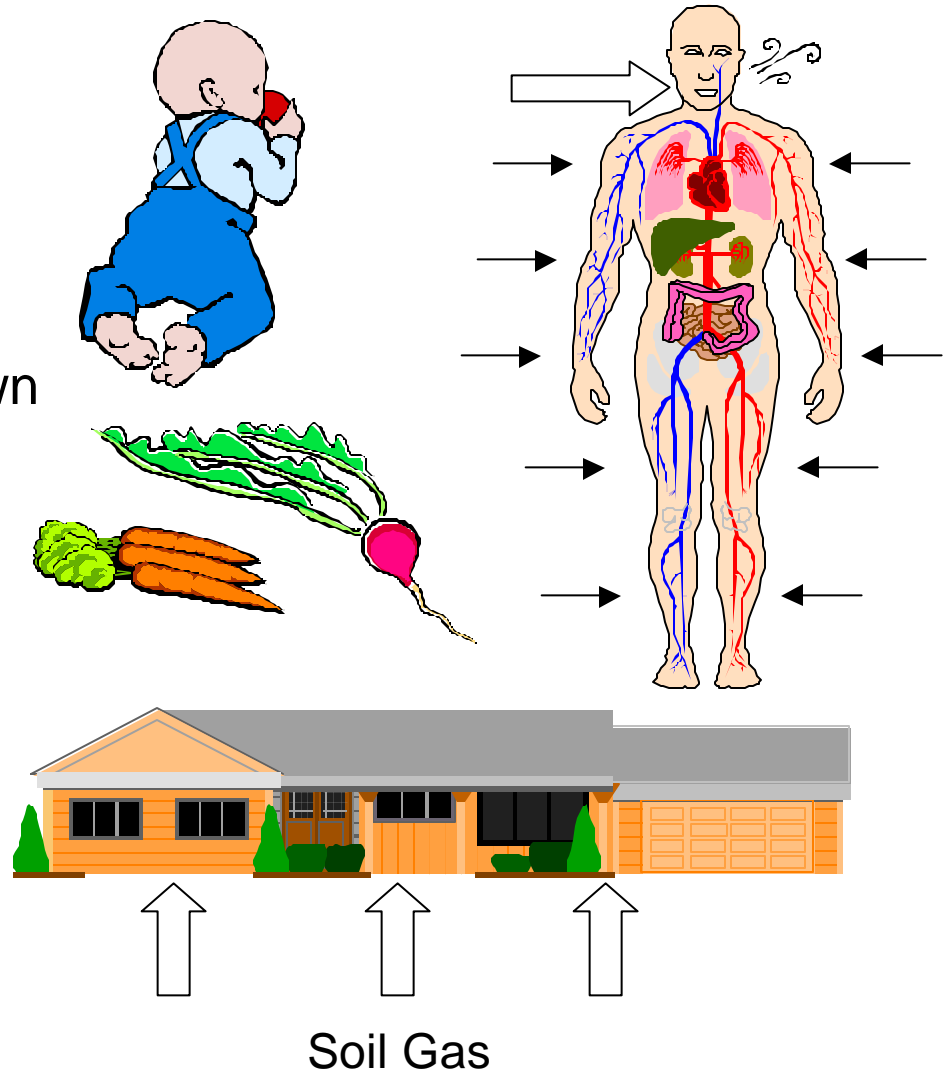
- Must pose no harm to any normal use by humans, plants or animals;
- Not adversely affect natural functions or cycles;
- Not contaminate other components of the ecosystem



**Domains of information considered in guideline development**

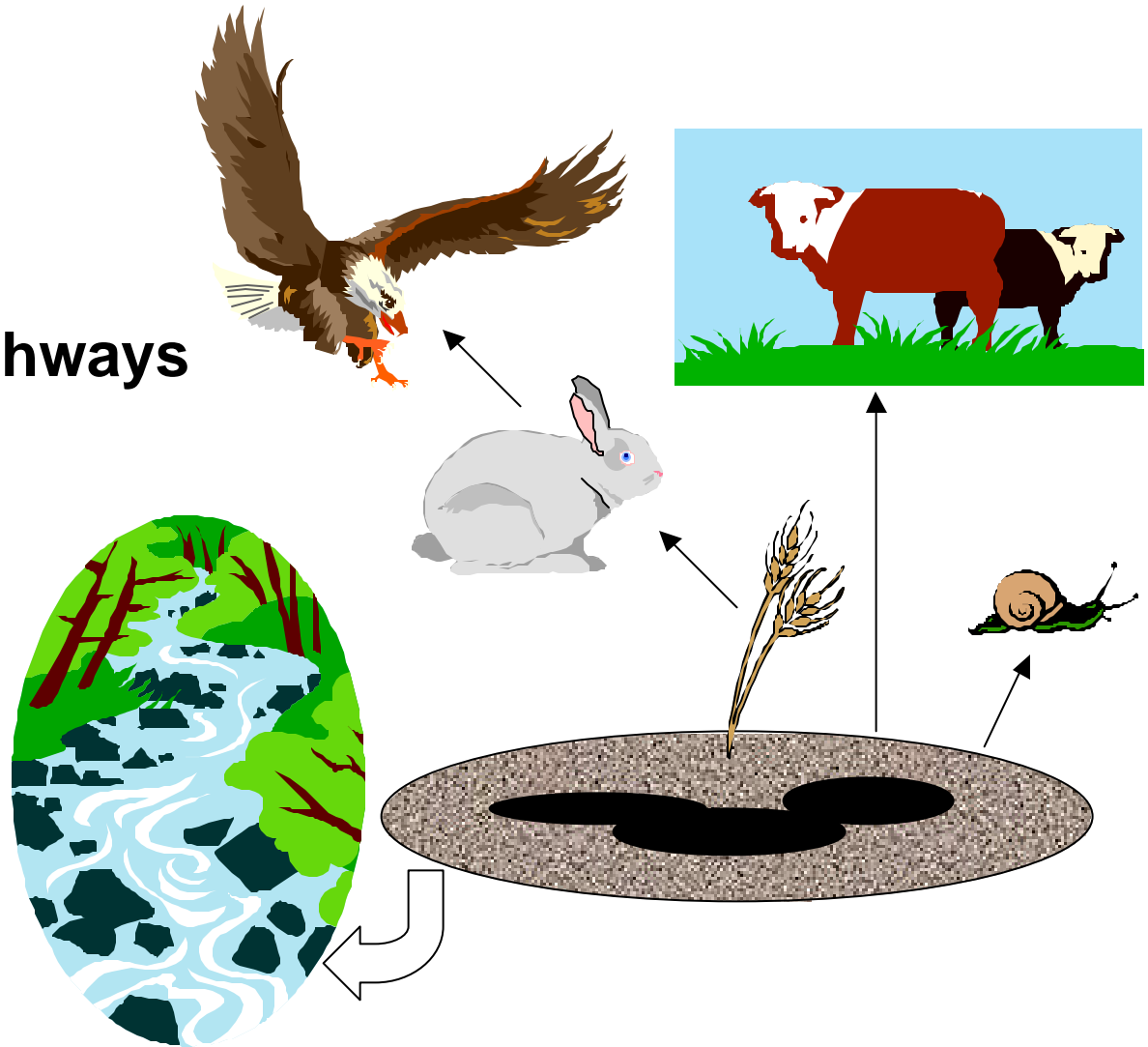
# Soil Risk Issues - Human Exposure

- **Ingestion**
  - child hand to mouth contact
  - vegetable/produce grown in contaminated soil
- **Inhalation**
  - vapour accumulation in buildings
  - airborne dust
- **Dermal Contact**
  - skin absorption



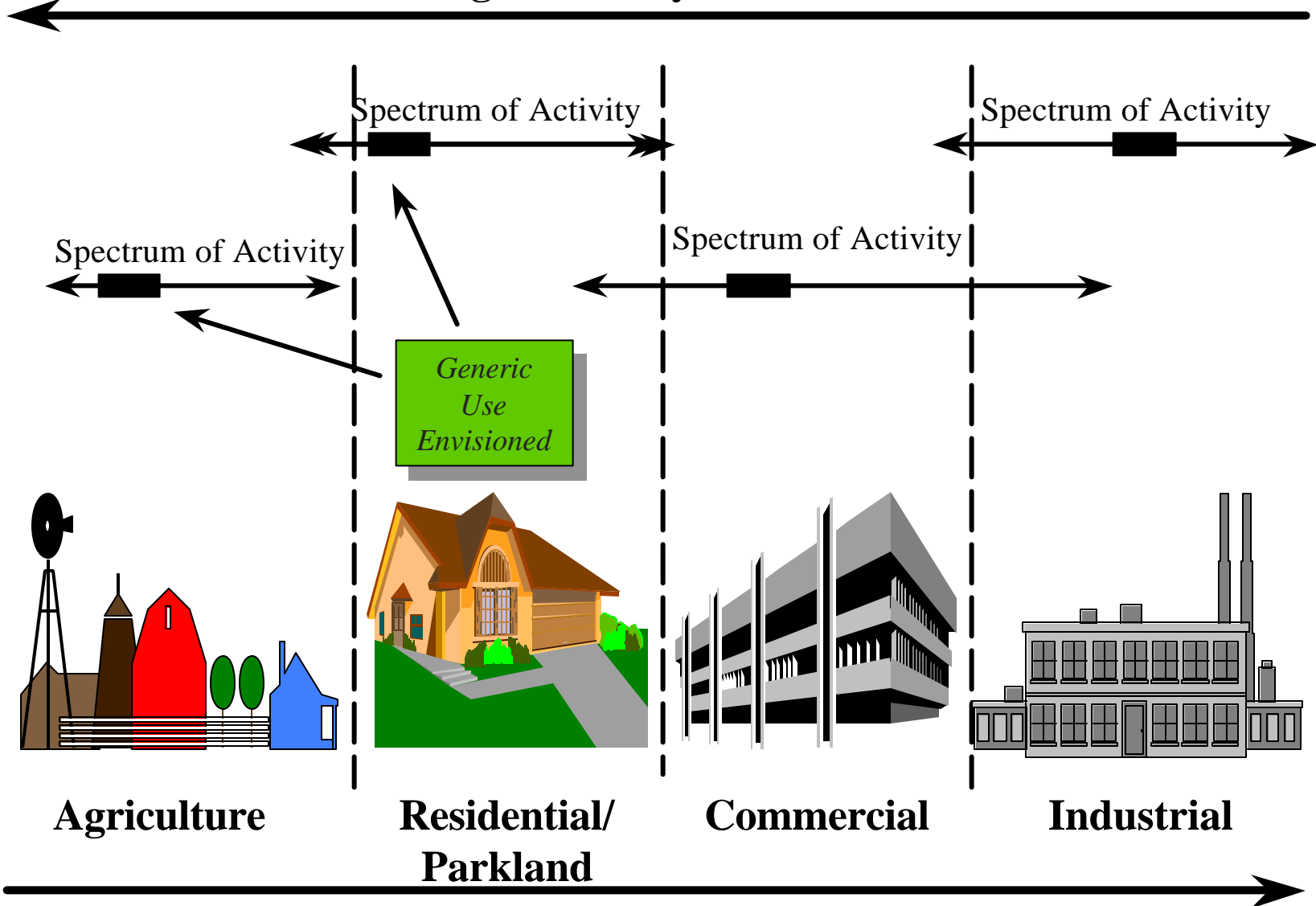
# Soil Risk Issues - Ecological Exposure

- **Soil Contact**
- **Secondary Pathways**
  - Soil to Air
  - Soil to Water
  - Soil to Plants
  - Accumulation





**Increasing Sensitivity to Contamination**



Decreasing Dependency on Ecological Components for Sustaining Land Use Activities

# Receptors of Concern

<b>Land Use</b>	<b>Agriculture</b>	<b>Residential /Parkland</b>	<b>Commercial</b>	<b>Industrial</b>
<b>Route of Exposure</b>				
Soil Contact	Crops/Plants Invertebrates Nutrient Cycling Processes Livestock/Wildlife	Plants Invertebrates Nutrient Cycling Processes Wildlife	Plants Invertebrates Nutrient Cycling Processes	Plants Invertebrates Nutrient Cycling Processes
Soil and Food Ingestion	Livestock/Wildlife			
Human Health (multimedia exposure)	Child	Child	(Child)	Adult

# Canadian Environmental Quality Guidelines (CCME 1999)

- **A compilation of existing Canadian environmental quality criteria for various media:**
  - air quality
  - water quality for drinking water supplies, recreational use, freshwater life and agricultural use
  - sediment quality
  - soil quality based on 1996 protocol (agricultural, residential/parkland, commercial and industrial uses)
  - includes listing of older CCME (1991) Interim Criteria
  - **does not include petroleum hydrocarbons (PHC)**

Canada-Wide Standard on  
Petroleum Hydrocarbons in Soil  
PHC CWS

# Canada-wide Environmental Standards Sub-Agreement

## Key features:

- departure from guidelines approach
  - greater public participation
  - sustainable development considerations
  - commitment to attain
  - public reporting
- integration with other processes
- implementation plans
- champion for each CWS
  - AB champions PHC CWS

# Why a CWS for PHC?

- Prevalence, environmental risks, remedial costs
- Presently little consistency among jurisdictions in:
  - approach to assessment
  - management benchmarks
  - analytical methods
- Results in:
  - non-comparability of data
  - confusion for stakeholders
  - imprecise (under- and over-) management
- *Objective is to provide a standard that is protective of human health and environment and improves consistency and accuracy of management*

# **Petroleum Hydrocarbons in Soil:**

## **Consultation**

### **Who:**

- **industry (oil and gas, insurance, financial, environmental), ENGOs, Farmer's Advocate, government (Health Canada, EUB, DND, NEB), universities, legal**

### **What:**

- **presentations, multistakeholder workshops and advisory groups, working groups, website postings**

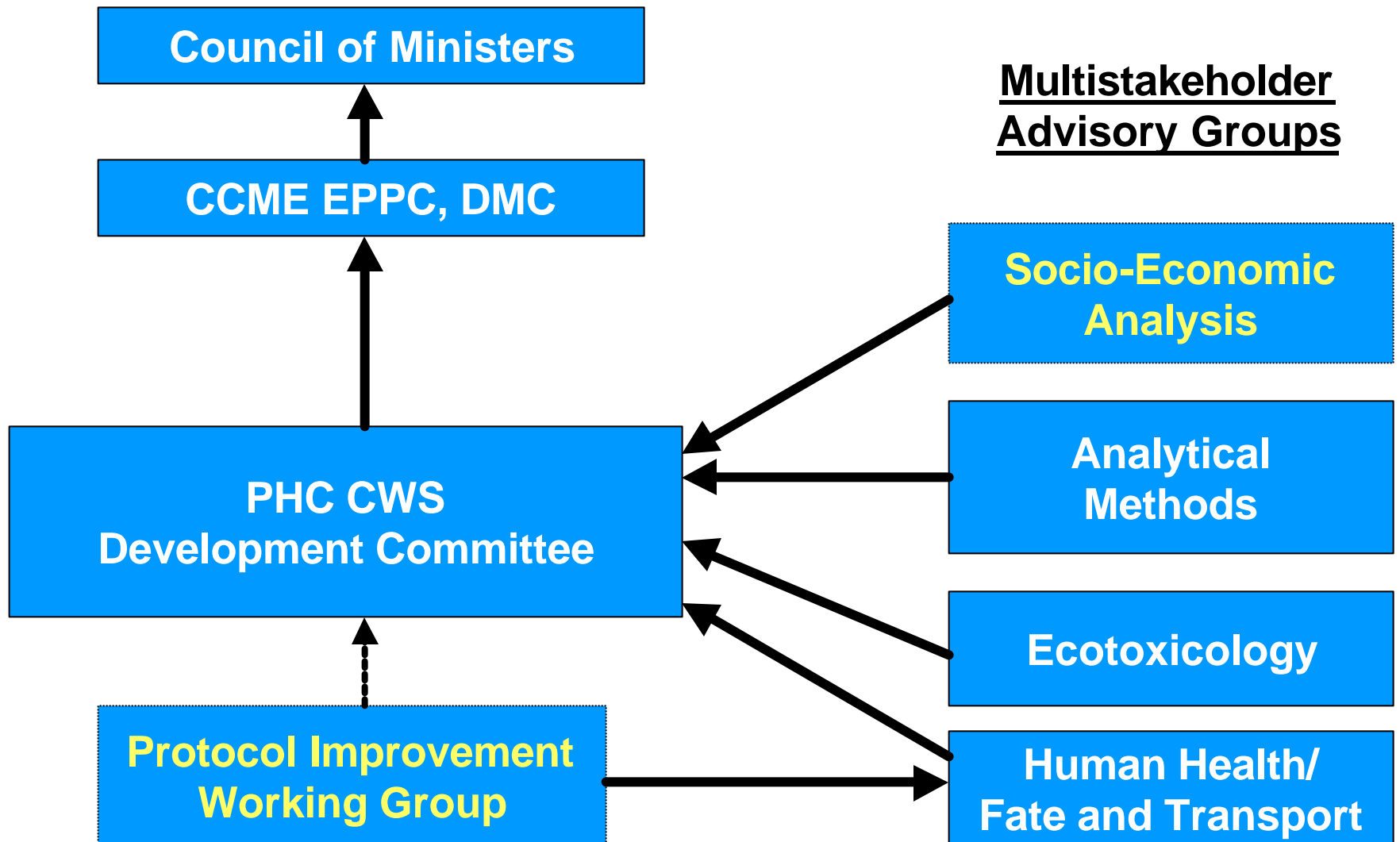
### **Why:**

- **ID stakeholder needs, generate recommendations, provide direction, confirm direction**

### **How:**

- **consensus process used throughout**

# PHC CWS Development





# **Canada-Wide Standard on Petroleum Hydrocarbons in Soil**

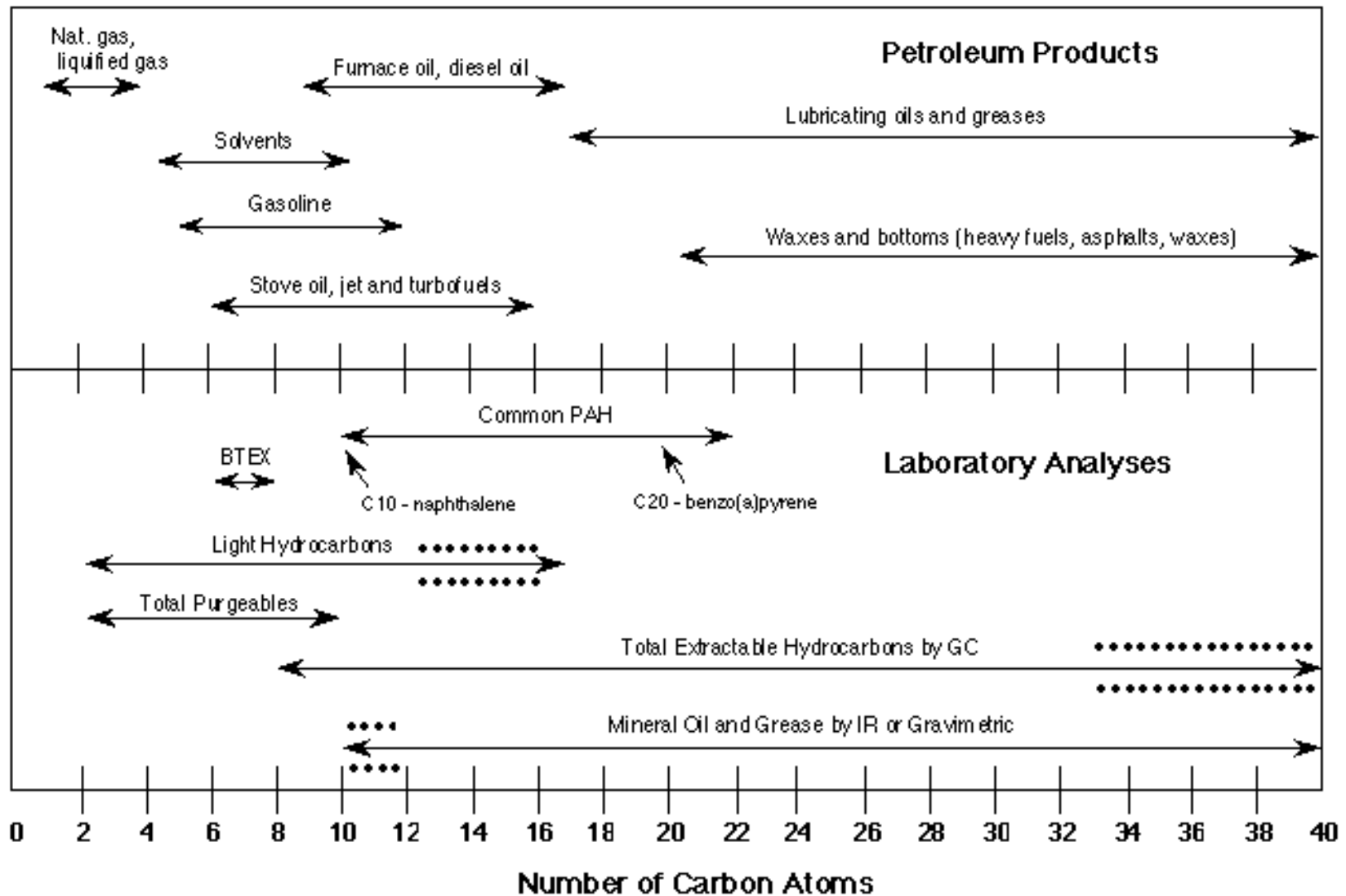
- **Remedial standard focused on approach and results**
  - jurisdictions address sites as they become priorities
- **Developed with multistakeholder input**
- **Includes socio-economic analysis**
- **Science-based; human and environmental health**
  - supports same land use categories as CCME 1999
- **Endorsed by Ministers May 1, 2001**

# PETROLEUM HYDROCARBONS

## Laboratory Analysis Methods

*High Mobility*

*Low Mobility*



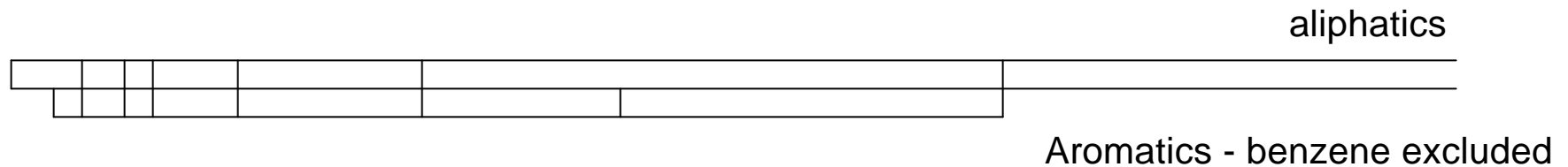
Note:  Test recoveries in these ranges are inefficient

# Grouping US TPH Criteria Working Group Sub-fractions

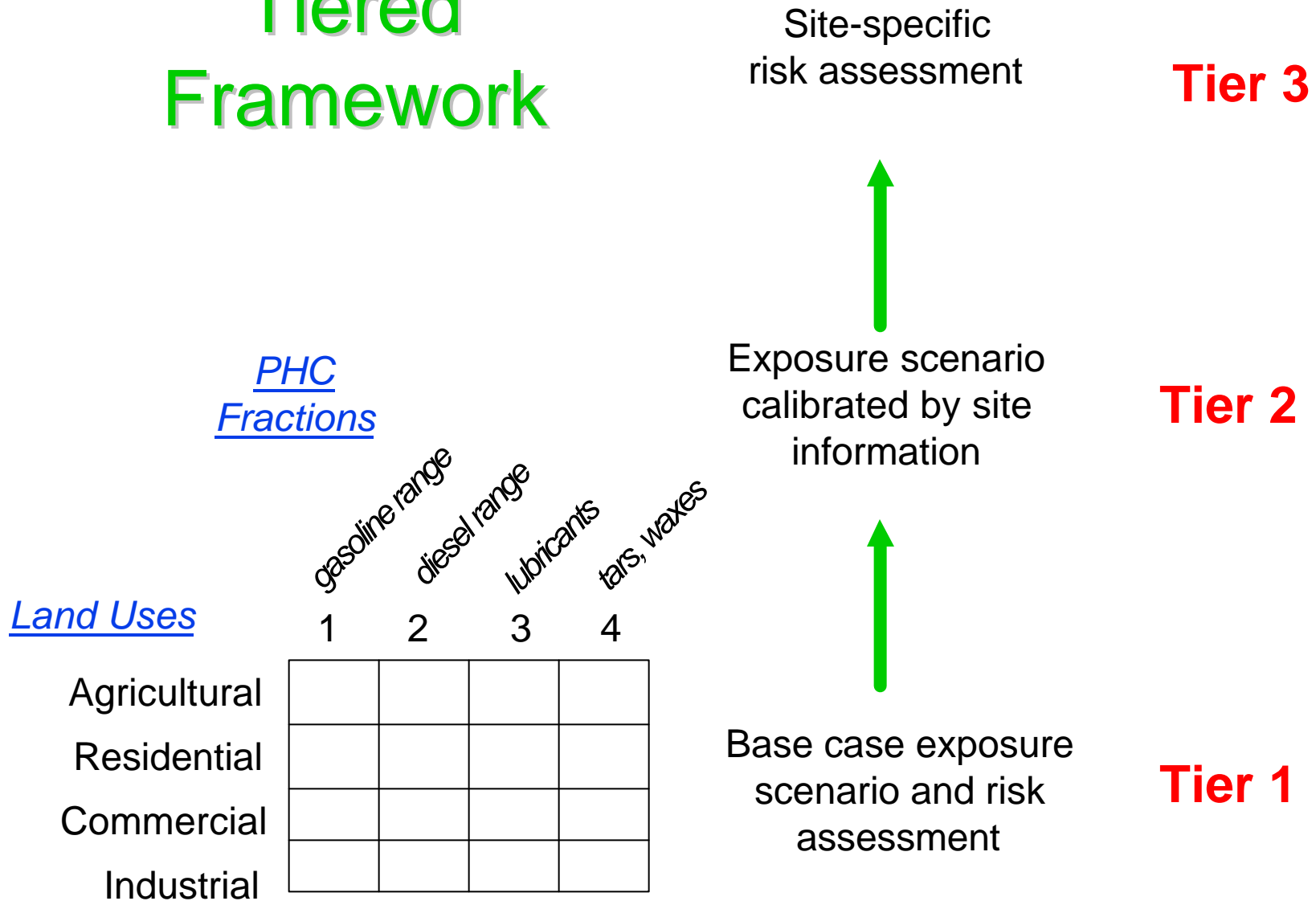
## CCME "Fractions":



## TPHCWG Sub-fractions:



# Tiered Framework



# Soil Texture

- Controls rate of movement of air, water and dissolved substances
- Regulates exposure along secondary pathways
- Tier 1 values developed for coarse (sandy) and fine (clayey) soils

# Generic Risk Assessment of PHC in Subsoil

*Unconsolidated, earthy, non-soil  
materials below 1.5 meters depth*

## Approach

- assess all relevant and applicable pathways
- protect aesthetic values and buried infrastructure
- subsoil must not serve as a significant source for contamination of surface soil or groundwater
- protection of workers in excavation activities
- assumed that subsoil remains subsoil

## **Canada-Wide Standard on Petroleum Hydrocarbons in Soil - Summary**

- **Three tiers with consistent protection at all tiers**
- **Different numerical Tier 1 levels for different land uses and petroleum hydrocarbon types**
- **Four fractions - C6-C10, >C10-C16, >C16-C34, C35+**
- **Soil, subsoil; coarse and fine textures**
- **BTEX “backed out” -- managed as a separate (but related) environmental issue**
- **Specific implementation measures up to each jurisdiction but must report to public and Ministers on actions and results**

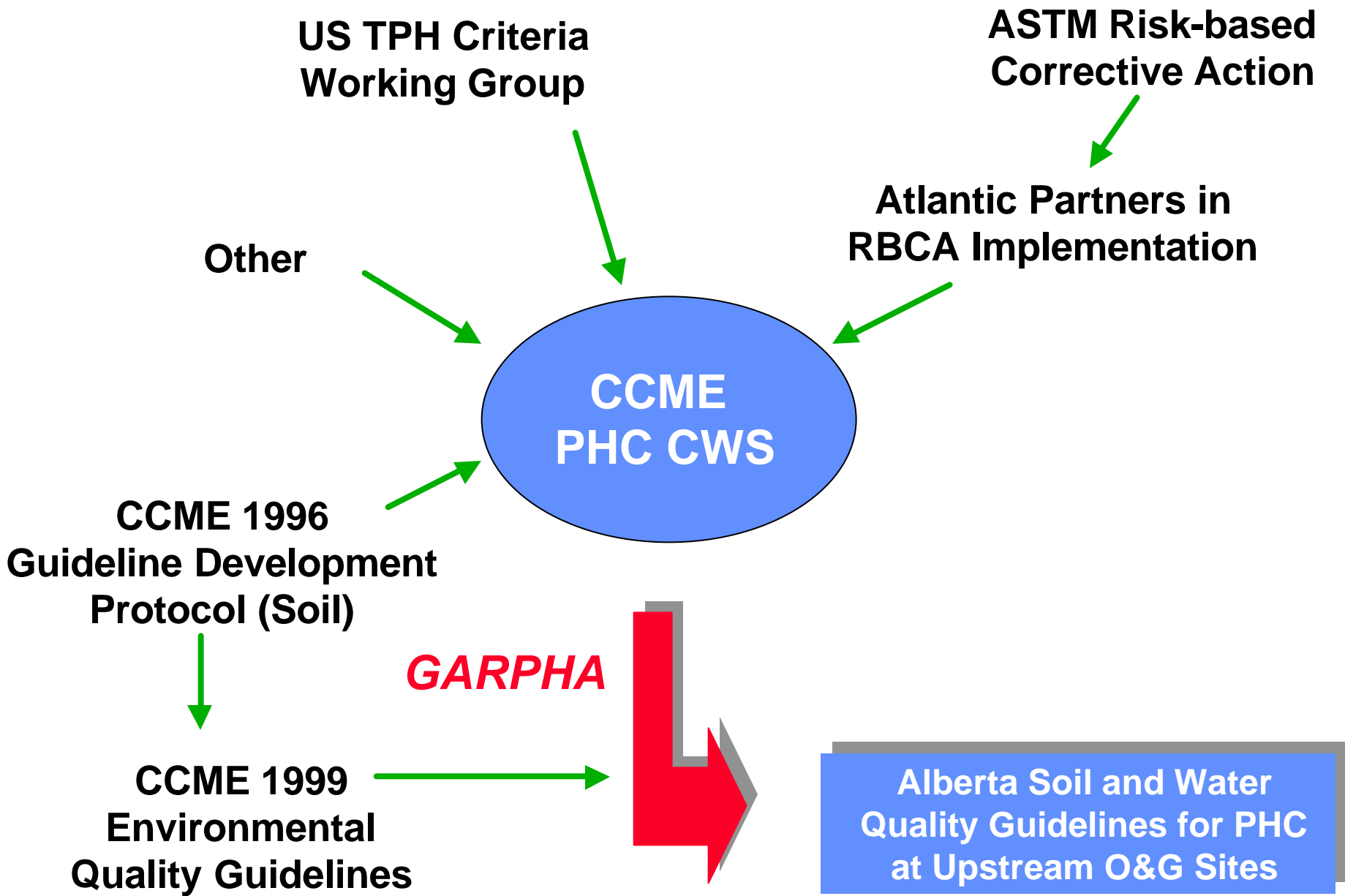
# **Alberta Implementation of PHC CWS:**

## **Stage 1 Project -- Geo-Environmental Assessment and Remediation of Petroleum Hydrocarbons in Alberta “GARPHA”**



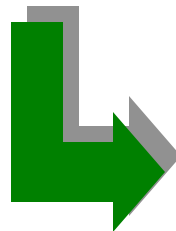
# **Harmonized PHC CWS and BTEX Implementation for Alberta Upstream Oil and Gas Facilities -- GARPHA**

- **calibrate PHC CWS for Alberta geological and climatic conditions**
- **provide guidelines for natural areas**
- **BTEX, PAH guidelines developed on same risk management basis as PHC CWS**
- **Guidelines for PHC, BTEX, PAH presented for soil, subsoil; coarse and fine textures**
- **Integrate concepts from reclamation/ remediation framework**



# Remediation Objectives: FY2001-02 Plan

- Alberta Tier 1
- CCME (1991) Interim Criteria
- Remediation Guidelines for PST sites
- Guidelines for Canadian Drinking Water Quality
- CCME (1999) Environmental Quality Guidelines
- CCME (2000) Petroleum Hydrocarbon Standard, GARPHA
- Alberta Salt Management Guidelines



**“Alberta Soil Quality  
Guidelines”**

# Summary

- 1. Alberta soil guidelines and standards based on national processes wherever possible**
- 2. Alberta leads development of the PHC CWS and is committed to harmonization of soil quality management**
- 3. Alberta Soil and Water Quality Guidelines for Upstream Oil and Gas sites build on national and provincial initiatives and are consistent with the PHC CWS**
- 4. Continued integration and harmonization of soil guidelines in FY 2001-02**