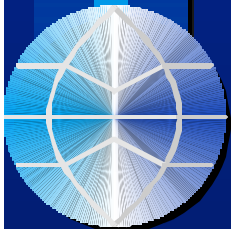


ALBERTA HYDROCARBON GUIDELINES SCIENTIFIC BASIS

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PRESENTATIONS

- **Scientific Basis**

- ◆ *How the Guidelines Were Calculated*

- **User Guide**

- ◆ *Which Guidelines to Use*

- **Case Study 1**

- ◆ *Flare Pit*

- **Case Study 2**

- ◆ *Pipeline Break*

SCIENTIFIC BASIS PRESENTATION

- ***Scope of Work***
- ***Soil Guidelines***
- ***Groundwater Guidelines***

SCOPE OF WORK

- **Expand and Adapt PHC CWS for Alberta**
- **Expand PHC CWS**
 - ◆ *More Hydrocarbons*
 - ◆ *More Land Uses*
 - ◆ *Groundwater*
- **Adapt PHC CWS**
 - ◆ *Modify Rainfall and Recharge Rate*

RISK-BASED GUIDELINES

- **Select Potential Exposure Pathways**
- **Calculate Protective Guideline for Each Pathway**
 - ◆ *Based on Land Use Scenario*
 - ◆ *Using Conservative, Generic Parameters*
- **Select Lowest Applicable Guideline for Each Chemical**

SCIENTIFIC BASIS PRESENTATION

- ***Scope of Work***
- ***Soil Guidelines***
- ***Groundwater Guidelines***

ALBERTA UPSTREAM GUIDELINES

- **9 Chemicals of Concern**
- **5 Land Uses**
- **2 Soil Types**
- **2 Soil Depths**
- **8 Exposure Pathways**

CHEMICALS OF CONCERN

- **BTEX**
- **Carcinogenic PAHs**
- **Hydrocarbon Fractions (F1, F2, F3, F4)**

LAND USE

- **Each Land Use Defines**
 - ◆ *An Exposure Scenario*
 - ◆ *A Set of Conservative Assumptions*

- **Four CCME Land Uses**

CCME LAND USES

■ **Agricultural**

- ◆ *Fully Exposed Toddler*
- ◆ *Livestock and Crop Pathways Considered*

■ **Residential**

- ◆ *Fully Exposed Toddler*
- ◆ *Garden Crop Pathways Considered*

■ **Commercial**

- ◆ *Toddler Exposed During Working Hours*

■ **Industrial**

- ◆ *Adult Exposed During Working Hours*

“NATURAL AREA” LAND USE

- **“Green Area” of Alberta Does Not Fit**
- **Define “Natural Area” Land Use**
 - ◆ *Similar To Agricultural*
 - ◆ *Human Uses Not Considered Limiting*
 - ◆ *Deer Substituted for Cattle*
- **Most of Alberta Now Included**

TWO SOIL TYPES

- **Coarse**

- ◆ Median Grain Size > 75 mm

- **Fine**

- ◆ Median Grain Size < 75 mm

TWO SOIL DEPTHS

- ***Surface Soil***

- ◆ Depth <1.5 m

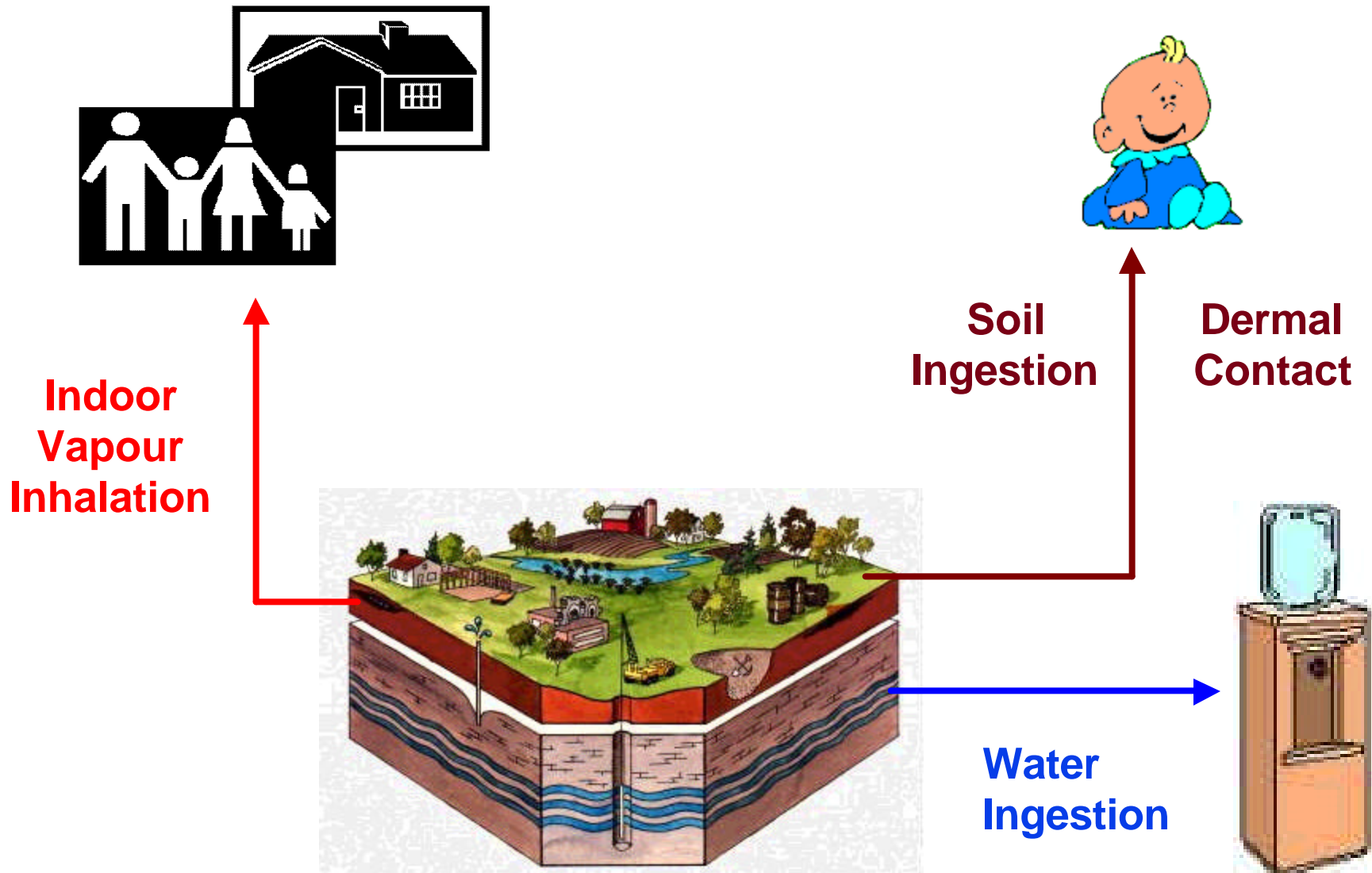
- ***Subsoil***

- ◆ Depth >1.5 m

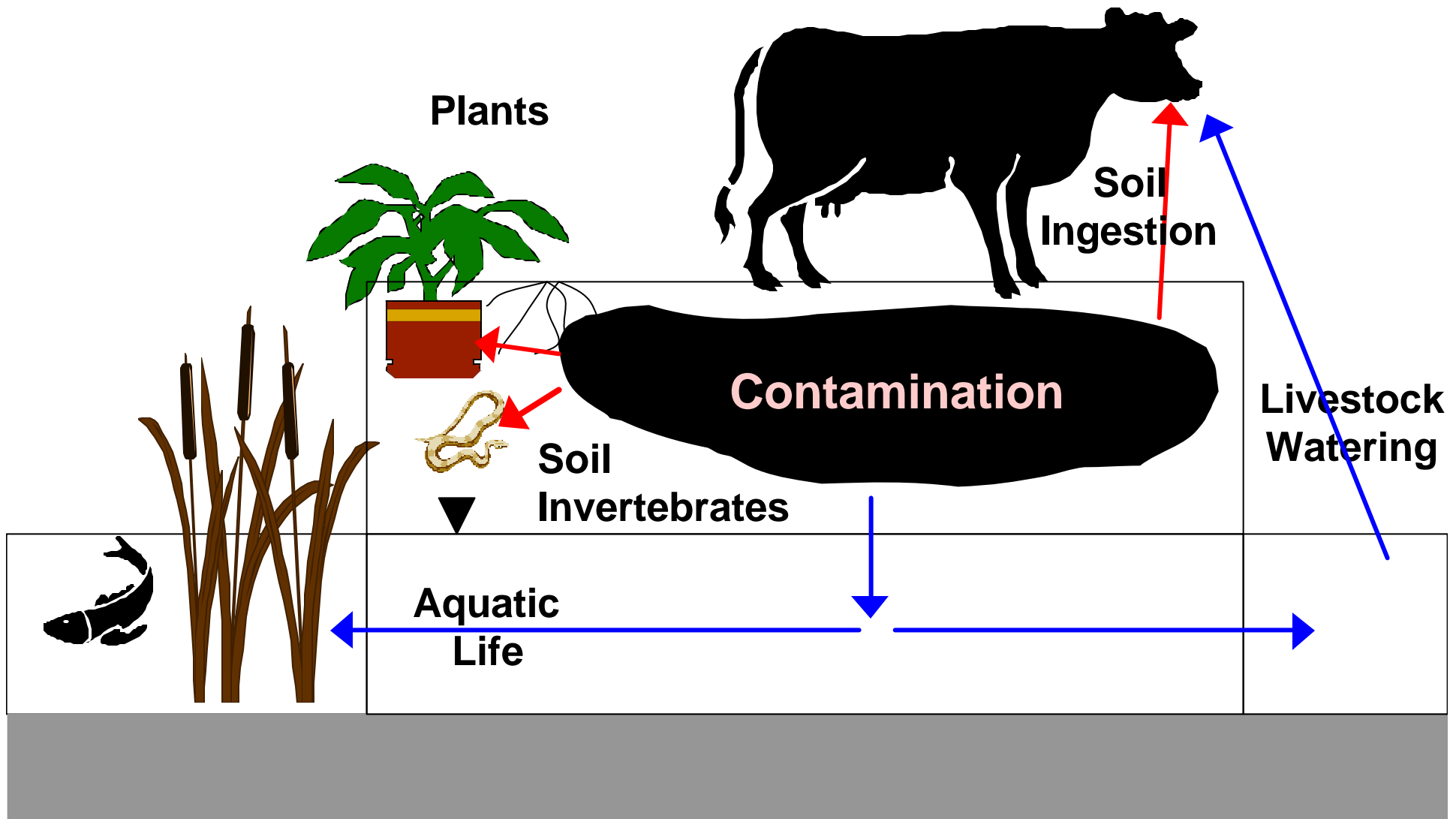
EXPOSURE PATHWAYS

- ***Human Pathways***
- ***Ecological Pathways***
- ***Calculate Guideline for Each Pathway***

Human Health Exposure Pathways



Ecological Exposure Pathways



HUMAN SOIL INGESTION/DERMAL

- ***Incidental Exposure Only***
- ***Pathways Rarely Limiting***

INHALATION OF INDOOR AIR

- ***Volatile Compounds Only***

- ◆ F1, F2, BTEX

- ***Processes Considered:***

- ◆ Volatilization at Source

- ◆ Diffusion

- ◆ Advection

- ◆ Mixing inside Building

- ◆ Inhalation

HUMAN INGESTION OF GROUNDWATER

■ ***Conservative (CCME) Model***

- ◆ **Infiltrating Rainwater Dissolves Hydrocarbons**
- ◆ **Pore Water Mixes with Aquifer Water**
- ◆ **Assumes Soil in Contact with Aquifer**
- ◆ **Canadian Drinking Water Quality Guidelines as Target**

ECOLOGICAL SOIL CONTACT

- ***Considers Plant and Soil Invertebrates***
- ***Based on Measured Toxicity Data***
 - ◆ **BTEX (AENV)**
 - ◆ **F1-F4 (PHC CWS)**

LIVESTOCK/WILDLIFE SOIL INGESTION

- ***Incidental Ingestion of Soil While Grazing***
- ***Food Ingestion Not Considered***
- ***Not Normally Limiting***

FRESHWATER AQUATIC LIFE

- ***Based on 4-Step PHC CWS Model***
 - ◆ **Dissolution in Pore Water**
 - ◆ **Downwards Transport to Water Table**
 - ◆ **Mixing with Aquifer**
 - ◆ **Groundwater Transport**
- ***Biodegradation Considered***
- ***Evaluated at 10 m Downgradient of Source***
- ***No Guidelines Required for Fine Soils***
- ***Endpoint is CCME Freshwater Aquatic Life***

LIVESTOCK/WILDLIFE WATERING

- ***Same Model as Aquatic Life***
- ***Endpoint is Health-Based Water Quality Guideline***
 - ◆ **Cattle**
 - ◆ **Deer**

SOIL GUIDELINE TABLES

- ***Tables 3-6 in User Guide***
 - ◆ **Table 3 - Fine Surface Soil**
 - ◆ **Table 4 - Coarse Surface Soil**
 - ◆ **Table 5 - Fine Subsoil**
 - ◆ **Table 6 - Coarse Subsoil**
- ***Each Table has 5 Land Use “Blocks”***
- ***Each Block has Multiple Pathways***

SCIENTIFIC BASIS PRESENTATION

- ***Scope of Work***
- ***Soil Guidelines***
- ***Groundwater Guidelines***

GROUNDWATER GUIDELINES

- ***Guidelines Adopted/Calculated For Mobile Compounds***
 - ◆ **BTEX**
 - ◆ **B(a)P (Human Drinking Water Only)**
 - ◆ **F1, F2**

- ***Flexibility Provided for Aquatic Life and Wildlife Watering***

- ***User Guide Table 7***

FOUR WATER USES

- ***Human Drinking Water***
- ***Livestock Watering***
- ***Freshwater Aquatic Life***
- ***Wildlife Watering***

HUMAN DRINKING WATER

- ***Health Canada Guidelines Adopted Where Available***
 - ◆ BTEX
 - ◆ B(a)P

- ***New Health-Based Guidelines Calculated***
 - ◆ F1, F2

LIVESTOCK WATERING

- ***New Health-Based Guidelines Calculated***

- ◆ **BTEX**

- ◆ **F1, F2**

AQUATIC LIFE AND WILDLIFE WATERING

- ***Biodegradation Included in Groundwater Transport Modelling***
- ***Many Plumes >10m from Exposure Point***
- ***Flexibility Provided for Distance and Soil Type***
 - ◆ ***Piezometer >10m from Surface Water Body (Coarse Soil)***
 - ◆ ***Piezometer <10m from Surface Water Body (All Soils)***

FRESHWATER AQUATIC LIFE

- ***CCME Guidelines Adopted Where Available***
 - ◆ **B, T, E**

- ***New Toxicity-Based Guideline Calculated***
 - ◆ **Xylenes**

- ***Guideline Not Calculated***
 - ◆ **F1, F2**

WILDLIFE WATERING

- ***New Health-Based Guidelines Calculated***

- ◆ **BTEX**

- ◆ **F1, F2**

SUMMARY

- ***Scientific Basis for Alberta Upstream Hydrocarbon Guidelines***
- ***Tables 3-7 in User Guide***
 - ◆ **Table 3 - Fine Surface Soil**
 - ◆ **Table 4 - Coarse Surface Soil**
 - ◆ **Table 5 - Fine Subsoil**
 - ◆ **Table 6 - Coarse Subsoil**
 - ◆ **Table 7 - Groundwater**