

Update on Barite Soil Quality Guidelines in Alberta and BC

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Presentation Overview

- Barite in Alberta
 - The Alberta Barite SQG – Refresher
 - Proposed Updates to Alberta SQG
- Barite in BC

Project Funding

- We Gratefully Acknowledge Project Funding from:
 - CAPP/SEPAC Broad Industry Initiative

Timeline – Alberta Barite Guidelines

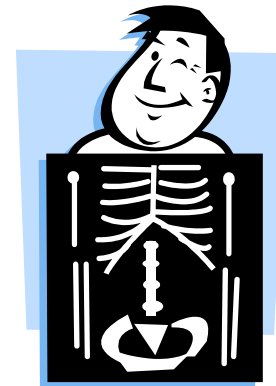
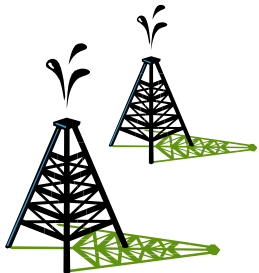
2003-2004	Development of Barite Guidelines (Phase 1)
2004	AENV Phase 1 Barite Guidelines
2005-2006	Barite Bioaccessibility Research
2007	Phase 2 Recommendations Submitted to AENV
2008?	AENV Phase 2 Barite Guidelines

Refresher – Properties and Uses of Barite

- Properties:
 - Barium sulphate BaSO_4
 - Heavy – density = 4.5 g/cm^3
 - Largely insoluble and inert

- Uses

- Oilfield drilling mud
- Medical x-rays



AENV (2004)

Barite Guideline Application

- Determine Maximum **Extractable Ba**
- Compare with **ExBa** Guideline:
 - 260 mg/kg (natural area, ag, res)
 - 440 mg/kg (com/ind)
- If **ExBa** Below Guideline:
 - Site is “Barite Site”:
 - Compare total barium to barite guidelines
Otherwise, use barium guidelines

Barite-Barium – Existing Alberta SQGs

Pathway	Nat. Area	Ag/Res	Com	Ind
Human Soil Ingestion	---	3,200	11,000	180,000
Off-Site Migration Check	---	---	---	41,000
Eco Soil Contact	180,000	180,000	180,000	180,000
Wildlife Soil Ingestion	3,300	3,300	---	---
Overall Guideline	3,300	3,200	11,000	41,000

Proposed Changes to Alberta Barite SQG

1. Revise Human TDI:

- Old = 0.07 mg/kg-bw/day (USEPA, 1999)
- New = 0.2 mg/kg-bw/day (USEPA, 2005a)

2. Revise Wildlife DTED:

- Old = 15 mg/kg-bw/day
- New = 51.8 mg/kg-bw/day (USEPA, 2005b)

3. Use Measured Barite Bioaccessibility

- Based on Barite Bioaccessibility of 55%

Barite-Barium – Proposed Revised Alberta SQGs

Pathway	Nat. Area	Ag/Res	Com	Ind
Human Soil Ingestion	---	20,000	30,000	500,000
Off-Site Migration Check	---	---	---	300,000
Eco Soil Contact	180,000	180,000	180,000	180,000
Wildlife Soil Ingestion	20,000	20,000	---	---
Overall Guideline	20,000	20,000	30,000	180,000

Analytical Challenge

- USEPA Method 3050B
 - Standard method in use in Alberta
 - Not effective for barite
 - Recovery only 20 – 50% at higher barite concentrations
- Fusion-XRF
 - Quantitative recovery of barium from barite

BC vs. Alberta Barite Approach

- Alberta
 - Demonstrate if “Barite Site”
 - extractable Ba < criterion
 - Then compare total Ba to barite guidelines
- BC
 - Demonstrate if “Barite Site”
 - Protocol 14
 - Then compare soluble Ba to barium guidelines

Timeline – BC Barite Guidelines

2006-2007	BC UPETG – Guideline Development
Oct 2007	BC Analytical Method for Soluble Ba Posted: http://www.env.gov.bc.ca/epd/remediation/analytical_methods/pdf/analytical_method_9.pdf
Nov 2007	Draft Ba Matrix Standard Posted for Comment
Currently	BCE Protocol 14 in Draft
2009-1010?	Revised BCE CSST Protocol

BC Soluble Barium Method



- Uses CaCl_2 Extraction
- Main Difference with AENV Method:
 - BC: 1 M CaCl_2
 - Alberta: 0.1 M CaCl_2

Draft BC Barium Matrix Standard

Pathway	AL	PL/RL	CL	IL
Intake of Contaminated Soil	6,500	6,500	20,000	-
Groundwater – Drinking Water	750	750	750	750
Plants and Soil Invertebrates	1,000	1,000	1,500	1,500
Livestock Ingestion	75	-	-	-
Groundwater - FAL	3,500	3,500	3,500	3,500
Groundwater - MAL	2,000	2,000	2,000	2,000
Overall Guideline	75	750	750	750

FAL = Freshwater Aquatic Life

MAL = Marine Aquatic Life

BC “Protocol 14”

- Protocol 14:
 - Demonstrates if you are a “Barite Site”
 - If so - you can use soluble barium
- Two Methods:
 - Documentary (Tour Reports etc.)
 - Analytical (SEM? XRD?)
- Must Analyze Background Samples

Summary of Barium Analytical Methods

- Soluble Barium
 - BC: 1 M CaCl₂
 - Alberta: 0.1 M CaCl₂
- Strong Acid Methods
 - BC: SALM
 - Alberta: USEPA 3050B
- Total Barium Methods
 - Fusion-XRF
 - Fusion-ICP

Summary - Alberta

- Use Soluble Ba to Show “Barite Site”
 - Total Ba Compared to Barite Guidelines
- Phase 2 Expected Soon:
 - Guideline values may increase, but
 - More aggressive analysis (e.g., Fusion-XRF) will be required

Summary - BC

- Use Records or Speciation to Show “Barite Site” (Protocol 14)
 - Soluble Ba Compared to Ba Matrix Standard
- Expected Soon:
 - Final Ba matrix standard
 - Release of Protocol 14