

DEVELOPING A GUIDELINE FOR THE MANAGEMENT OF BARITE IN SOIL

Introduction

Barite (barium sulphate) is used as a weighting agent in the majority of oilfield drilling muds, and consequently, is present on many active and decommissioned well sites as a result of mud disposal practices. Currently, barium in soil at well sites in western Canada is typically managed using the Canadian Council of Ministers of the Environment (CCME) agricultural guideline of 750 mg/kg. The CCME guideline is based on a limited dataset comprising studies on the toxicity of soluble barium compounds to plants and invertebrates. However, barite is highly insoluble, and accordingly, the current CCME barium guideline is likely unnecessarily conservative for the management of barite.

Technical Steering Committee and Funding

This project was managed by a technical steering committee consisting of industry, regulators and consultants. The TSC members are summarized below.

- Chris Meloche ChevronTexaco
- Philip Langille Talisman
- Gordon Dinwoodie Alberta Environment
- Todd Hann Saskatchewan Environment
- Miles Tindal Axiom Environmental

The project was funded by the CAPP/SEPAC broad industry initiative, Alberta Environment and Newpark Environmental.

Scientific Basis

The guidelines for barite in soil were calculated from available physical, chemical, fate, and toxicological data for barite, using protocols from the Canadian Council of Ministers of the Environment (CCME) and Alberta Environment (AENV). A new study was commissioned on the toxicity of barite to plants and soil invertebrates, and demonstrated that barite is virtually non-toxic to these biota.

Developing guidelines for barite presented two specific challenges related to the fact that barite is an inorganic compound, rather than an element. Specifically, the challenges were to determine whether barium measured at a field site is actually in the form of barite, and if so, whether it will stay that way. These challenges are discussed further in the two following paragraphs.

There is currently no commercially-available analysis for barite (as distinct from barium). Accordingly an indirect approach was required. A new methodology was developed for determining the concentration of extractable barium in soil. Measurements of extractable barium were correlated with the response in a series of toxicity tests on plants and soil invertebrates using a soluble barium compound. Thus, a threshold was determined for extractable barium, below which no adverse effects were anticipated for plants or soil invertebrates.

Concerns were raised about two processes that might cause barium to be mobilized from barite over time, namely microbial reduction of the sulphate in barite, and displacement of barium by the addition of salts. These concerns were addressed by a nine-month soil microcosm research program commissioned from the University of Alberta. The program demonstrated that neither of these processes was likely to be a concern under typical field conditions.

Guideline Application

Application of the guideline has two phases. First it must be determined whether the site conforms to the requirements for a "Barite Site". A Barite Site is defined as a site where the **extractable barium** at all locations is less than:

- 260 mg/kg (natural area, agricultural, residential); or,
- 440 mg/kg (commercial, industrial).

If the requirements for a Barite Site are met, then the Barite Guidelines can be applied. The Barite Guidelines apply to **total barium** and are as follows:

- 3,300 mg/kg (natural area)
- 3,200 mg/kg (agricultural)
- 3,200 mg/kg (residential)
- 11,000 mg/kg (commercial)
- 41,000 mg/kg (industrial)

If the requirements for a Barite Site are not met, then the existing applicable guideline for barium (*e.g.*, CCME or AENV guideline) would be applied as before.

Regulatory Implementation

As of early March 2004, the state of regulatory implementation is as follows:

- Alberta Environment expect to have a draft document on their website for public review very soon.
- Saskatchewan Environment have participated on the TSC for the project - contact Todd Hann to discuss implementation in Saskatchewan.
- British Columbia have expressed an interest in reviewing the guidelines.

Further Information

Contact either:

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