DILUTED BITUMEN SPILL IMPACTS: NGO PERSPECTIVE

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Roadmap

I. International standards for defining bitumen
II. Alberta’s methodology for defining “bitumen”
III. Attributes of Alberta’s bitumen deposits
IV. Overview of existing diluted bitumen spill behavior studies
V. Kalamazoo spill case study
VI. Evaluation of likely routes for tar sands diluted bitumen by pipeline in the United States
What is bitumen?

COMMONLY USED DEFINITIONS

- Density (API <10, )
- Viscosity (>10,000 cSt)
- Recovery method

Viscosity-density relationship of crude oil, heavy oil, and bitumen*

*Note: The diagram shows the viscosity-density relationship for conventional crude oil, heavy crude oil, and bitumen. The data points for each category are as follows:

- Conventional Crude Oil: Viscosity = 10 mPa·s (cP), Density = 884 kg/m³, Gravity = 35 °API
- Heavy Crude Oil: Viscosity = 1,000 mPa·s (cP), Density = 966 kg/m³, Gravity = 15 °API
- Tar Sand Bitumen: Viscosity = 1,000,000 mPa·s (cP), Density = 1,000 kg/m³, Gravity = 10 °API
## Standards for defining bitumen

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<th>Type</th>
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Alberta Energy Regulator definition for bitumen

**Definition:** “Crude bitumen is extra heavy oil that in its natural state does not flow to a well.”

- **Exception 1:** “For administrative purposes, the geological formations and the geographic areas containing the bitumen are designed as oil sands areas (OSAs). Other heavy oil is deemed to be oil sands if it is located within an OSA.”

- **Exception 2:** “Since some bitumen within an OSA will flow to a well, it is amenable to primary development and is considered to be primary crude bitumen in this report.”

Where Alberta bitumen is produced

Alberta’s Oil Sands Areas (OSA)

Densities of bitumen produced in Oil Sands Areas

- Cold Lake bitumen*: API 9.8 – 13.2
- Athabasca bitumen: API 5.7 – 9
- Peace River bitumen: API 7

Density of Saskatchewan heavy crude

- Lloydminister heavy crude: API 12 - 14
Cumulative Primary (Conventional) Production by OSA (barrels)

Production by OSA in 2013 (barrels per day)

Planned “in situ” expansion by OSA (barrels per day)

Problems with freshwater diluted bitumen spill behavior studies

**Freshwater Studies (all using Cold Lake Winter Blend)**

- Heather Detman, “Natural Resources Canada Study: High Energy Weathering”, presented to NAS in March 9th-10th hearing
- Low energy weathering in “fish tanks” (Alberta Innovates Technology Futures, AITF), being finalized

**Problems with use of Cold Lake Winter Blend**

- Cold Lake production considered heavy and not bitumen by most standards (API 10-14)
- Cold Lake blend is not representative of bitumen production
- Winter blends have higher diluent to bitumen ratio
Marine diluted bitumen spill behavior studies

Marine Studies indicating diluted bitumen may sink in marine environments:


Other Marine Studies

- CLB and AWB. Federal Government Technical Report: Properties, Composition and Marine Spill Behaviour, by Environment Canada, Fisheries and Oceans Canada, and Natural Resources (November 30, 2013)

- CLB and AWB. Witt O’Briens, Polaris Applied Sciences and Western Canada Marine Response Corporation, A Study of Fate and Behavior of Diluted Bitumen Oils on Marine Waters (2013),

- CLB. SL Ross Environmental Research Limited, Meso-Scale Weathering of Cold Lake Bitumen/Condensate Blend (2012)

Ralph Dollhopf, EPA incident commander for the Kalamazoo spill, July 24, 2011:

“At minimum, we’re writing a chapter in the oil spill cleanup book on how to identify submerged oil. We’re writing chapters on how it behaves once it does spill (and) how to recover it...

Submerged oil is what makes this thing more unique than even the Gulf of Mexico situation. Yes, that was huge—but they knew the beast they were dealing with. This experience was brand new for us. It would have been brand new for anyone in the United States.”

Mark Durno, EPA deputy incident commander for the spill, June 27, 2012:

“We had no idea sinking oil would be such a problem... Not only was this material submerged but it was mobile and moving along the river bottom.”

Susan Hedman, EPA’s Midwestern chief, Aug. 16, 2012

“The EPA staff that worked on this, that have responded to oil spills over many, many years, had never encountered a spill of this type of material, in this unprecedented volume, under these kinds of conditions.”
What was spilled in Kalamazoo River?

Christina Lake / Foster Creek Diluted Bitumen

According to Enbridge Wastewater Treatment Plan for Marshall Spill (Approved by EPA on Aug. 8, 2010 (pages 25-28)*

- Christina Lake blend: bitumen produced by SAGD with an API gravity of approximate 8 degrees.**
- Foster Creek blend: bitumen produced by SAGD with API densities ranging from 7 to 9 as viscosity at initial reservoir condition of 870,000 cPs.***
  - Considered in Athabsca OSA by AER and Cold Lake OSA in Comprehensive Regional Infrastructure Sustainability Plan for Cold Lake OSA.
Mayflower, Arkansas diluted bitumen spill
Where is tar sands likely to be transported in the U.S.?
Leak detection remains a challenge
THANK YOU