



NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

The Science and Technology for Heavy Oil Spills

Heavy Oil Working Group

September 22nd, 2015

Bogotá, Colombia



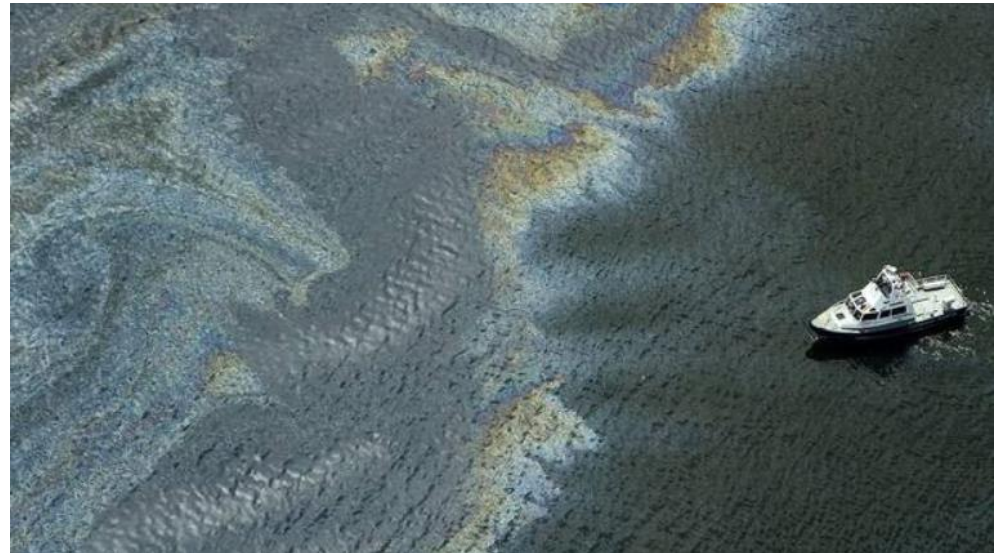
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Heavy oil properties and behaviour in water determine impact of oil spills and their recovery...

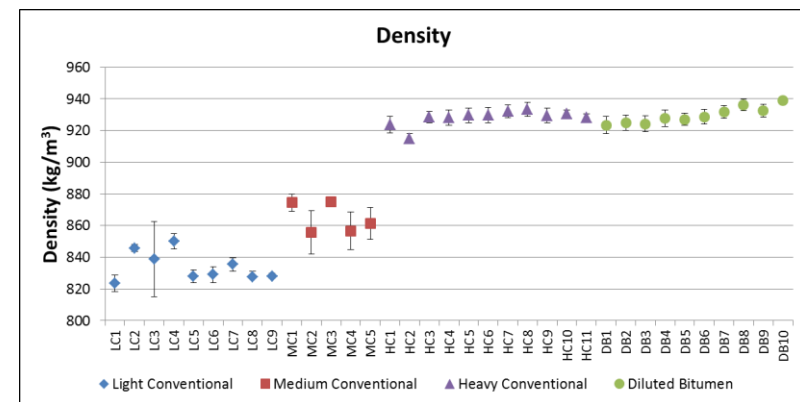
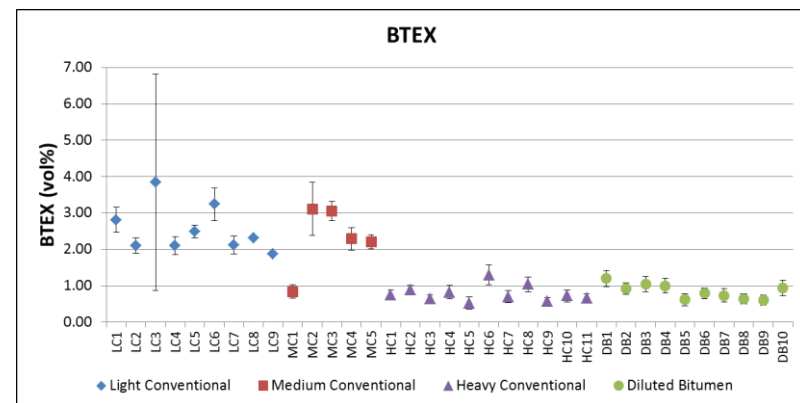
- Canada ships oil products to other markets --- increasing public concerns about oil spills and safety regimes
 - research is looking at whether diluted heavy oil spill behaviour differs from conventional crudes
 - this knowledge will help ensure we have the correct spill response protocols and technologies



Burrard Inlet diluted bitumen spill. Photo credit: The Globe and Mail

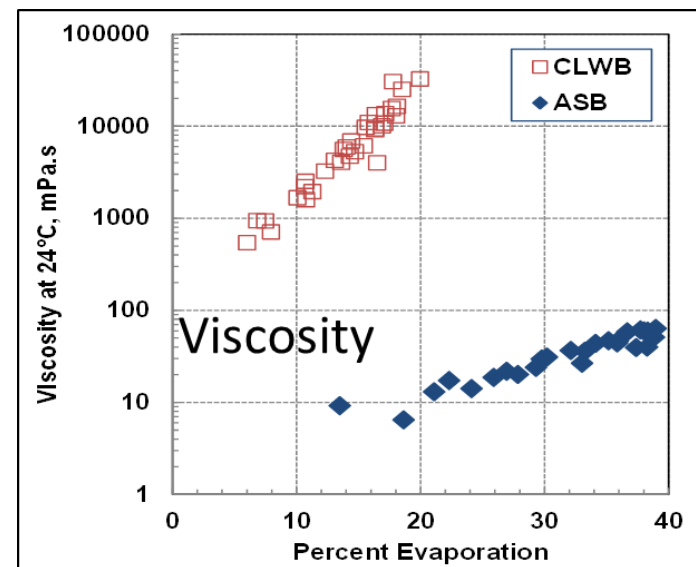
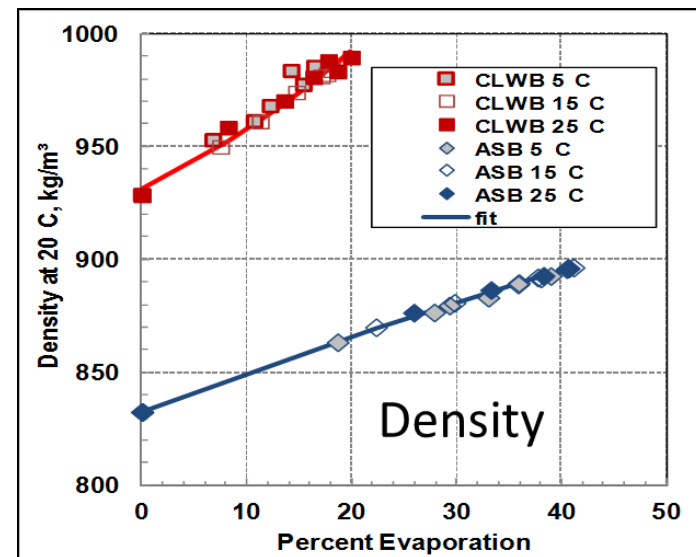
...and we are looking at how diluted heavy oils compare to conventional crudes...

- Chemical composition and physical properties of an oil affect spill behaviour
 - depends on composition
 - composition determines physical properties
 - physical properties determine spill behaviour (does it sink, does it easily spread, does it emulsify)
- Due to differences in composition and properties across oil products (light conventional to diluted bitumen), they may behave differently when spilled



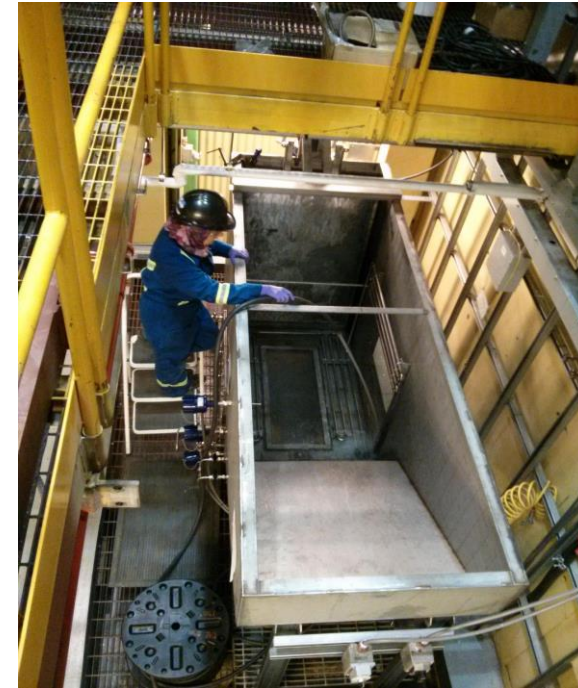
...over the course of a simulated oil spill...

- Compare how properties of conventional crudes and diluted heavy oils change over time in a spill
 - density changes in diluted bitumen and light crude are relatively small after weathering
 - density of diluted heavy oil never reached 1,000 kg/m³ in 10 days
 - diluted heavy oil experienced 500 times increase in viscosity in 10 days
- This type of information will
 - guide spill response protocols
 - aid development of heavy oil spill response technologies



...using our wave tank test facilities...

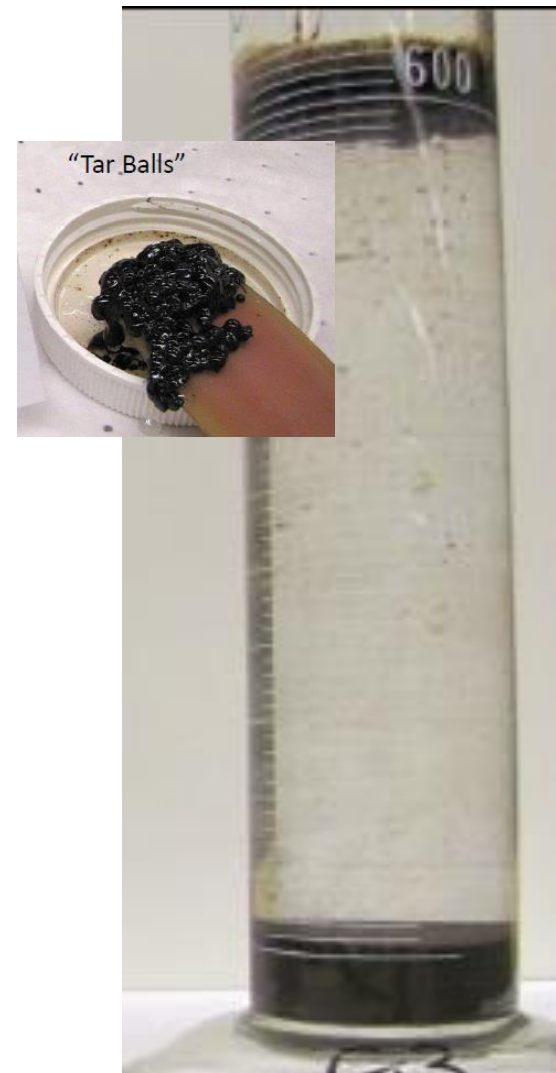
Materials		
Water	Sediments	Oil
1,200 L	2,000 ppm	7.5 kg
North Sask., Edmonton	North Sask. Flood plain, Edmonton	CC: Mixed Sweet Blend (LC8)
pH: 8 TDS ~400 ppm	21% clays, 78% silts, & 1% sands	Diluted bitumen: Cold Lake, DB4
	Mixed into water	Poured fresh onto surface



...have seen interesting results on buoyancy...

- Similar to light and heavy oils
 - diluted bitumen floats on pure saltwater, even after evaporation and exposure to light and mixing with water
 - some fraction of spilled diluted bitumen can sink, or form floating tarballs¹ when mixed (e.g., by strong wave action) with suspended sediment (more dense than seawater)

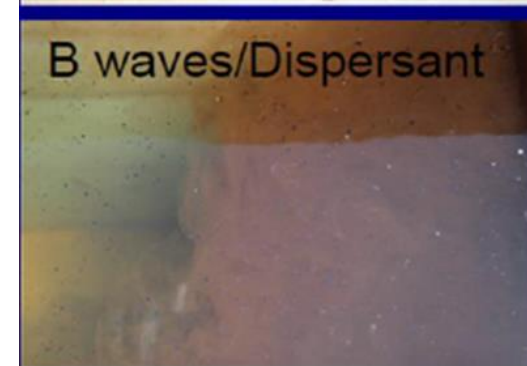
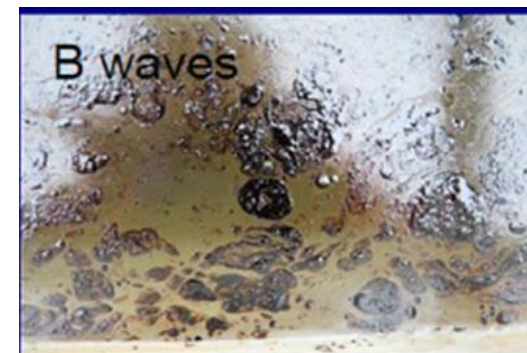
¹The term "tarball" is used in the scientific literature to refer to the consistency of floating, heavily-weathered oil. It does not describe the chemical composition of the product.



...provides opportunity for improved response technology.

Several approaches to spill recovery - physical containment and recovery, dispersants, burning.

- Dispersants:
 - differences seen in effectiveness of dispersants between conventional crudes and diluted heavy oils
 - such results will guide response protocols
- Mechanical recovery
 - federal program to fund new recovery technology development;
 - industry testing of existing technologies – found to be effective on diluted heavy oils. Can they be improved?



Opportunities for Collaboration

- Welcome comparison of samples from diverse sources for testing
 - characterisation (chemical and physical properties)
 - weathering tests
 - wave tank tests
 - recovery tests
- Welcome collaboration on spill response and technology development

Thank You!

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