Properties & Behaviors of Non-Floating Oils (NFOs)

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Types of NFOs

Though most crude and refined oils float, some don't; either due to their inherent density or because their density changes via some weathering process (sedimentation or possibly evaporation). NFOs can either be submerged (suspended in the water column) or sunken (on the bottom). General NFO types:

- Oils that are heavier than water and mostly sink when spilled
- Oils that are lighter than water and sink after mixing with sediment (several examples)
- Oils that are lighter than water but become heavier as the lighter fractions are lost by evaporation (very few examples)

Important Oil Characteristics

Understanding an oil's **density** is clearly important, but so is the oil's **viscosity** and its **persistence**. While density affects where in the water column you may find the oil, its viscosity will affect the degree of physical dispersion and may affect interactions with sediment. Under the right conditions, floating oils that persist long enough may sink due to weathering processes (sedimentation, evaporation, etc).

Laboratory and field experience shows that most floating oils will not become denser than the receiving water due to evaporation alone. However, oils with a density close to that of the receiving water can become submerged in the water column under turbulent conditions. When this occurs, interaction with suspended or bottom sediments can cause oils to be heavier than receiving waters and sink in quiescent areas.

Diluted bitumen or "dilbit" is composed of about 70-80% bitumen (with very large, heavy molecules) and 20-30% diluent (with very small, light molecules that can evaporate easily). Other heavy oils typically have little if any light components at all, so we expect evaporation to have a more pronounced effect on dilbit density compared to other oils. Most of the increase in dilbit density caused by evaporation takes place in the first day or two.

Safety Data Sheets (SDSs) are too generic to be useful when planning for/responding to spills. Obtain chemical assay info from shipper (seller) or receiving facility (buyer). If a Canadian crude, then even the name of the crude will be more informative than an SDS for purposes of understanding the oil's characteristics & behavior in the environment. Low tech (benchtop) option… Command Post science demo: place a source sample into some receiving water and see what happens.

Important Receiving Water Characteristics

Seawater (°API = 6-7) is denser than freshwater (°API = 10), so know the **density** of the receiving waters. Also, understanding the local **currents/turbulence** and potential for **oil interaction with sediments** (turbidity, shoreline/bottom interactions) will also be important, particularly with floating, persistent oils.

Considerations & Potential Data Gaps

- Getting good info on oil and receiving water characteristics quickly can be critical
- Does evaporation substantially affect densities of most/all dilbits?